Vol. 22
No. 2

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

SHOP ANNUAL NUMBER

CONTENTS

Industrial-Arts and Vocational-Education Activities in Various Cities

The Work in Everett, Wash., *by E. P. Fait* . 35

The Work in Peoria, Ill., *by L. P. Elliott* . . 41

Lighting the School Shop

The School-Shop Lighting Problem, *by Walter Sturrock* 45

Shop Subjects

Woodworking Equipment, *by Orville A. Tearney* 50

Machine Drafting in Industry, *by Raymond R. Bloom* 52

Care of Tools in the Metal Shop, *by E. L. Bowman* 53

Course II — Auto Mechanics, *by H. Allan Lacey* 55

Simplified Trouble Shooting, *by Edward B. Flaherty* 58

Printshop Instruction Sheets, *by E. H. Rueter* 59

Developing a General-Shop Course, *by Lester C. Smith* 104

Toolroom Method, *by Wesley L. Orr* . . . 114

A Drawing-Assembly Room, *by Vick L. Langford* 120

Shop Layouts

Woodshop — Industrial-Arts Laboratory — Electrical Shop — Auto Shop — Industrial-Mechanics Shop — Composite Shop — Printshops — General Shop — Farm Shop 62

Supplements

Story of the File, *by Clifford B. Smith* . No. 259

Carrying Case for Drawing Tools, *by Glenn H. Osborne* . . . . . No. 260

Problems and Projects

Carrying Case for Drawing Tools, *by Glenn H. Osborne* 65

Leather Craftwork, *by Ross C. Cramlet* . . 65

A Project in Ornamental Wood Turning for the School Shop, *by Lemuel Harris* . . . 66

Toolmaker's Clamp, *by E. C. Youngbluth and W. A. DeVette* 66

Electric Table Lamp, *by Gerald A. Boate* . 67

Development of Grocer's Scoop, *by John McGrath* 69

Teaching Them Their P's and Q's, *by J. E. Fintz* 69

Collecting Shop Fees, *by R. L. Grandle* . . 70

Modernistic Book Ends, *by Louis F. Barocci* 70

Circular Saws, Their Characteristics and Use — IV, *by John E. Doren* 84

Student Progress and Graph Cards, *by Chester A. Lyle* 88

Equipment and Supply Lists

Woodworking 72

Metal Working 93

Sheet Metal 102

Automotive 106

Electrical 110

Drafting 117

Printing 122

Price of This Issue $1.00

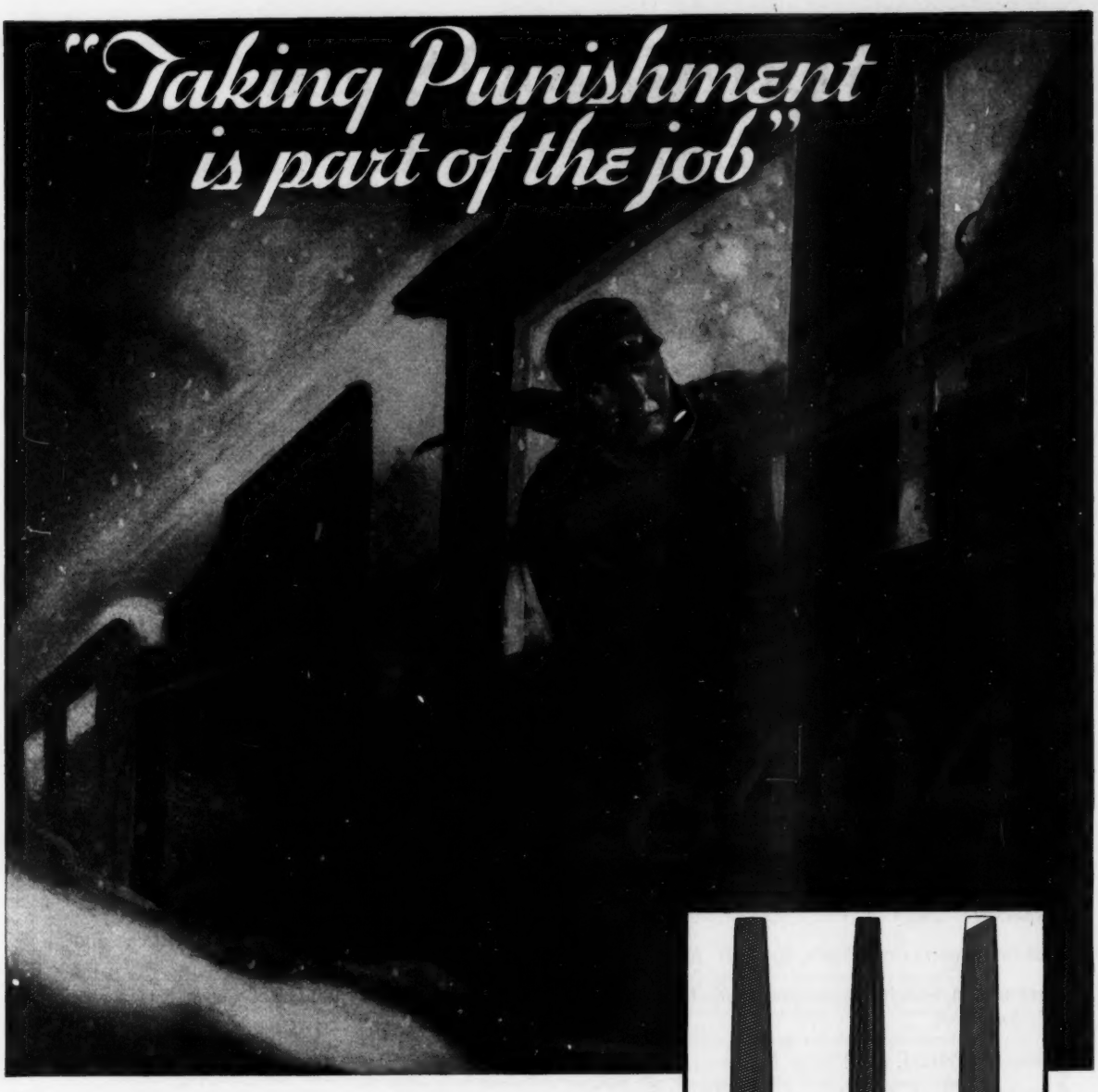
Articles Indexed—The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."

Entered Jan. 2, 1914, as second-class mail matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright, 1932, by Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, Nov. 25, 1930.

Subscription Information—Subscription price, $2.50 per year, payable in advance. Canadian postage and tariff, $1.00, foreign countries, 50 cents. Copies not over three months old, 25 cents; more than three months, 50 cents. Notices for discontinuance of subscription must reach Publication Office in Milwaukee, at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions.—The Editors invite contributions bearing upon Industrial Arts, Vocational Education, Manual Training, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago; Philippine Education Co., Manila, P. I.

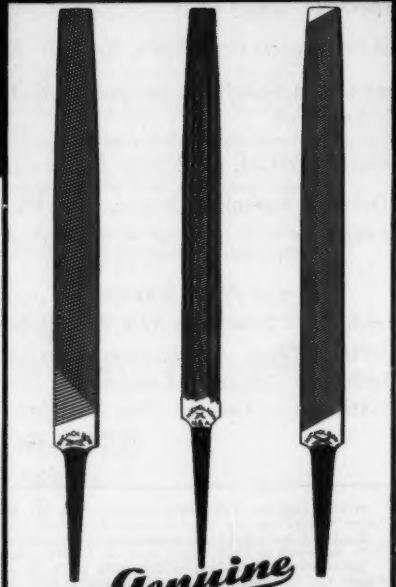


THE railroad engineer does not flinch from the blinding storm — for taking punishment is part of his job.

And in the railroad shops, Nicholson Files are also doing gruelling work, standing up under conditions, as hard in their way, as the engineer meets on the road.

If you believe with the railroads, that only files of the highest quality can show real net profits on each filing job, show your students the application of this theory by having them use Nicholson Files.

At hardware and mill supply dealers. Nicholson File Company, Providence, R. I., U. S. A.



Genuine
NICHOLSON FILES

A FILE FOR EVERY PURPOSE

Industrial-Arts and Vocational-Education Activities in Various Cities

The Work in Everett, Washington

E. P. Fait

Vocational Director,
Vocational School, Everett, Washington

This article shows how the work in industrial arts and vocational education is organized and conducted in a city with a population of 30,587.

THE Everett school system is organized on the 6–3–3 plan. Two types of industrial work — industrial-arts and trade work — are given.

Industrial-arts work is being offered in eight grade schools, two junior high schools, and in the senior high school with a teaching force of twenty in the industrial-arts and vocational-education department.

The industrial-arts work is based upon the following objectives:

To develop in the pupil skill and clear thinking in the various processes involved in shopwork.

To develop initiative and give the pupil confidence in his ability to do things.

To discover interests and aptitudes that have significance in lifework.

To develop manipulative ability and job intelligence with the common tools and materials useful for jobs found in home life and spare-time activities.

To develop industrial intelligence and an intelligent appreciation of industrial work and its place in society.

The grade-school work is very elementary, involving the use of small tools and simple operations. Most of the projects made are toys.

In the junior high school, mechanical drawing, electricity, metal work, and woodwork are offered.

In the North Junior High School these are all specialized subjects, but due to the smaller size of the South Junior High School we are forced to run the metal and electrical work together, thus forming a general shop, while mechanical drawing and woodwork are specialized.

One semester of each type of work is required of every boy in the seventh and eighth grade. These courses are looked upon as introductory courses. The work in the ninth grade is elective.

It is the special duty of industrial-arts teachers to try to discover special interests and aptitudes in students and have them enroll in high-school subjects and activities which will develop these aptitudes and interests.

Layouts of three North Junior High School shops may be seen in BRUCE'S SCHOOL SHOP ANNUAL for 1930, pages 73, 195, and 219.

In the high school our industrial-arts courses are more highly specialized than those given in the junior high schools. All classes are run one hour a day and five days a week, and courses in mechanical drawing, architectural drawing, machine drawing, electricity, machine shop, auto mechanics, woodshop, and aëronautics are offered.

General Metal-Electric Shop, South Junior High School, Everett, Washington

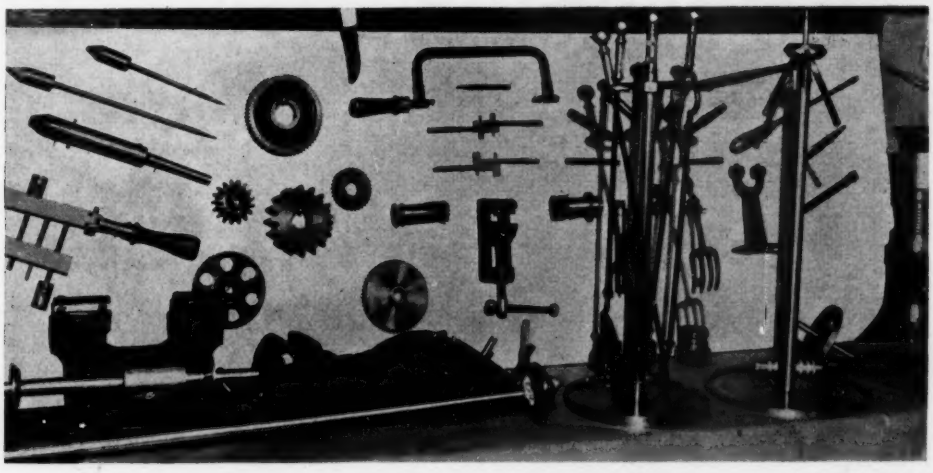
Mechanical drawing is a foundation course for all industrial-arts and vocational majors. The first semester's work includes orthographic projections and working drawings. It is a prerequisite to architectural drawing or house planning.

Architectural drawing is an elective except for those who choose the carpentry trade. In the architectural-drawing class all plans for houses built by the carpentry class are prepared. Both boys and girls may elect architectural drawing. It is one of the most popular subjects in the industrial-arts and vocational-education department. It is given from the stand-

point of the future home owner rather than that of the training of architects.

The main reference books used in this department are: *Applied Architectural Drawing,* by T. R. Abercrombie,[1] and *Better Homes Manual,* by Blanche Halbert.[2]

tals and various uses of electricity, but the shopwork is based upon the home-mechanics idea. Care and repair of household electrical equipment is a large part of the work. Boys in this class not only keep their own equipment in repair but many citizens of the community take advantage of this service



Panel showing work done in Machine Shop, Senior High School, Everett, Washington

Machine drawing is given from the standpoint of the future industrial worker, patternmaker, or designer. This course is required of all machine-shop majors. *Machine Drawing Problems,* by Berg and Elleson,[3] is used as a text.

Electricity is elective and given as a prerequisite to electric-trade work. It is both exploratory and informational. It is largely a study course involving the theory and fundamentals which is free. The text used is *Essentials of Applied Electricity,* by Jones.[4]

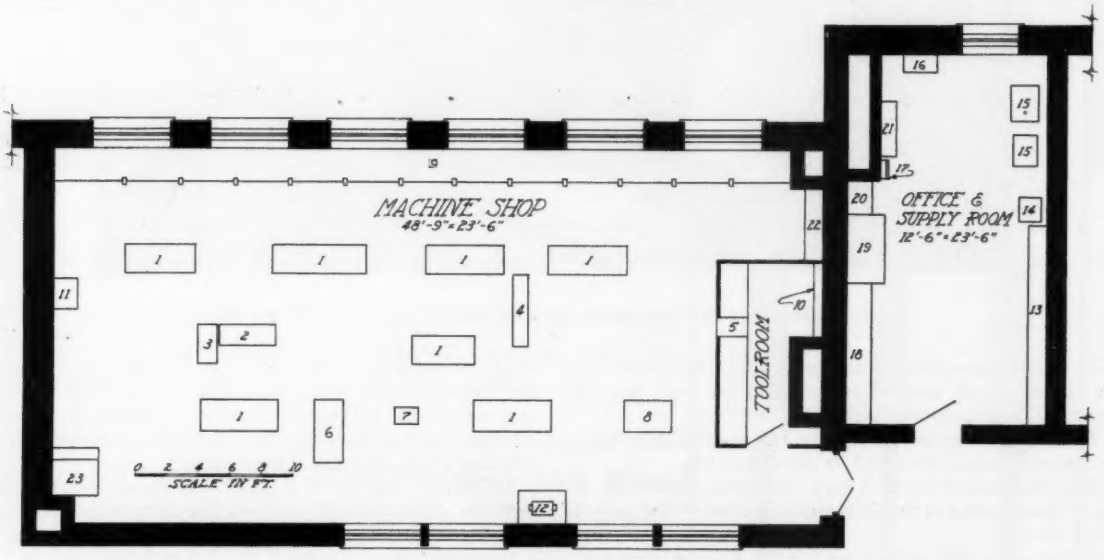
Machine-shop work is elective to all except automobile and electrical-trade students. Due to local conditions, this course is very general. Besides the usual machine-shop equipment of lathes, shapers, milling machines, drill presses, etc., there is a unit each in acetylene welding for plumbers, forging, steam engines, and steam pumps. Many of the boys who have taken this work find placement in industry because of their knowledge of steam plants. Boys may specialize in any

[1] *Applied Architectural Drawing,* by T. R. Abercrombie. The Bruce Publishing Co., Milwaukee, Wis.

[2] *Better Homes Manual,* by Blanche Halbert. University of Chicago Press, Chicago, Ill.

[3] *Machine Drawing Problems,* by Berg and Elleson. Manual Arts Press, Peoria, Ill.

[4] *Essentials of Applied Electricity,* by E. W. Jones. The Bruce Publishing Co., Milwaukee, Wis.



Everett High School, Everett, Washington

1. Lathe
2. Drill Press
3. Hack Saw
4. Chuck Holder
5. Steel Plate — Toolroom Window
6. Shaper
7. Power Grinder
8. Milling Machine
9. Workbench with 12 Vises and 25 Compartments
10. Tool Panel
11. Acetylene Welding Outfit
12. Electric Motor
13. Rack for Material: Iron, Steel
14. Generator
15. Steam Engine
16. Steam Water Pump
17. Switchboard
18. Supply Cabinet
19. Desk
20. Filing Cabinet
21. Display Cabinet
22. Wash Rack
23. Forge

unit of this work. This training quite often leads to a job as a millwright. Our main reference is *Advanced Machine Work*, by Smith.[5]

Auto mechanics is a one-year course and is exploratory and informational. It is largely a study course. Three hours a week are devoted to study and two hours in the shop. *Automotive Essentials*, by Kuns,[6] is used as a text.

Work for the auto shop is obtained by coöperating with various wrecking houses who furnish wrecked cars. These are disassembled, cleaned, and after having served as a basis for study and practical work, are returned to the wrecking house. Boys from this group who show the proper interest, aptitude and desire are selected to continue the work in the trade class. Thirty students are accommodated in an elementary auto-mechanics class.

The woodshop course is elective for all except carpentry-trade students. The outline of study for this course is based upon processes.

The problem of storage or locker space for individual students was solved by building cross partitions under the woodwork benches thus forming compartments which run clear through. A door is placed on one end only, and the doors of adjoining compartments are on opposite ends. Since these woodwork benches are 4 ft. wide and from 10 to 16 ft. long, the lockers thus formed are large enough to accommodate 95 per cent of all projects made. Two boys are assigned to a locker and there are 75 lockers. To provide space for assembled or partly assembled jobs, lockers were along the wall under the windows. There also is a balcony over the finishing room which provides additional room for assembled projects. *Principles of Woodworking*, by Hjorth,[7] is the text used in the woodshop.

The class in aëronautics has proved very popular. There are thirty in a class, and many who want to take the work must be turned away.

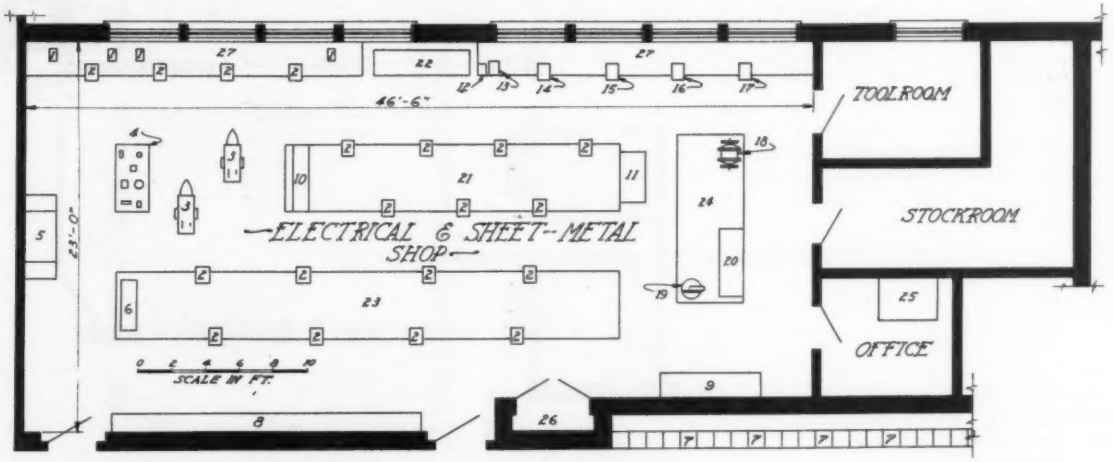
In this class the boys learn the principles of flying and of airplane construction. In the shop they build scale models

Theory Room, Electric Shop, Everett Senior High School, Everett, Washington

[5] *Advanced Machine Work*, by R. H. Smith. Industrial Education Book Co., Back Bay, Boston, Mass.

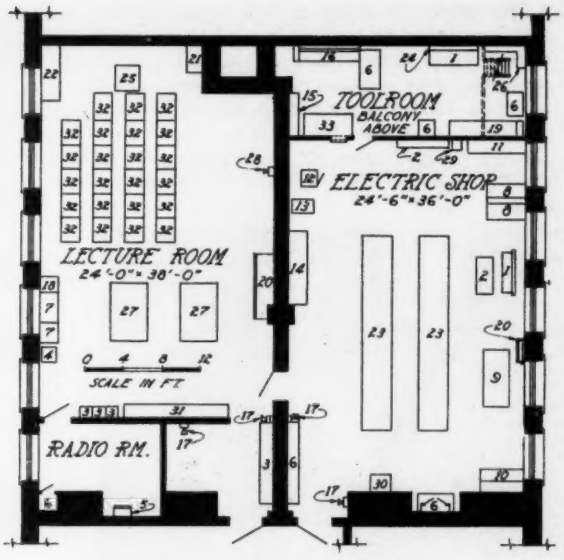
[6] *Automotive Essentials*, by Ray F. Kuns. The Bruce Publishing Co., Milwaukee, Wis.

[7] *Principles of Woodworking*, by Herman Hjorth. The Bruce Publishing Co., Milwaukee, Wis.



South Junior High School, Everett, Washington

1. Furnaces
2. Vises
3. Anvils
4. Stake Bench
5. Wash Rack
6. Bar Folder
7. Lockers
8. Bookshelves
9. Sheet-Metal Rack
10. Forming Rolls
11. Squaring Shears
12. Wiring Machine
13. Spot Welder
14. Beading Machine
15. Burring Machine
16. Turning Machine
17. Crimping Machine
18. Grinder
19. Drill Press
20. Metal Lathe
21. Bench 4 by 20 ft. with lockers below
22. Electrical Test Board
23. Bench 4 by 30 ft. with lockers below
24. Bench 4 by 10 ft.
25. Desk
26. Exhibit Case
27. Bench 2 ft. wide with lockers below



Everett High School, Everett, Washington

1. Transformers
2. Metal Lathe
3. Metal Lockers, Student
4. Battery Charger
5. Radio Transmitter — Short Wave Set
6. Supply Cabinet
7. Resistance Control
8. Test Board, Electric
9. Test Bench
10. Battery Rack and Lamp Bank
11. Shelf
12. Bake Oven for Baking Coils — Electric
13. Power Emery Grinder
14. Workbench
15. Tool Rack
16. Tool Cabinet
17. Phone — Experimental
18. Batteries for Broadcasting and Experimenting
19. Battery Charger and Repair Bench
20. Switchboard
21. Filing Cabinet
22. Books
23. Workbenches each with 22 compartments for Lockers
24. Motor Generator Set for Broadcasting
25. Teacher's Desk
26. Shelves
27. Motor Test Benches
28. Office Phone
29. Drill Press
30. Wash Rack
31. Library
32. Desks
33. Bench

of different types of airplanes. Three hours a week are spent in classroom study, and two hours are spent in the shop. *The Cadet System of Ground School Training in Aviation,* by Lieut. Leslie Thorpe,[8] is used as a basis for study.

In connection with the high school, there are three trade classes which are operating under the Smith-Hughes Law. These are auto mechanics, electricity, and carpentry. These classes are conducted from 8:30 a.m. to 12:30 p.m., thus allowing trade boys to carry two academic subjects if they wish in the afternoon. The first hour in the morning is spent on related subjects. The next three hours are spent on the job either in school or in industry.

During his first year in high school, the student can finish all prerequisites required for shopwork. He may then join one of the trade classes in his junior year and finish his trade course at the time of graduation. In this way he receives a trade certificate at the same time that he gets his diploma. In the case of a carpentry student, the certificate is equivalent in rating to two years' apprenticeship and the boy may immediately join the local union and draw wages as a third-year apprentice.

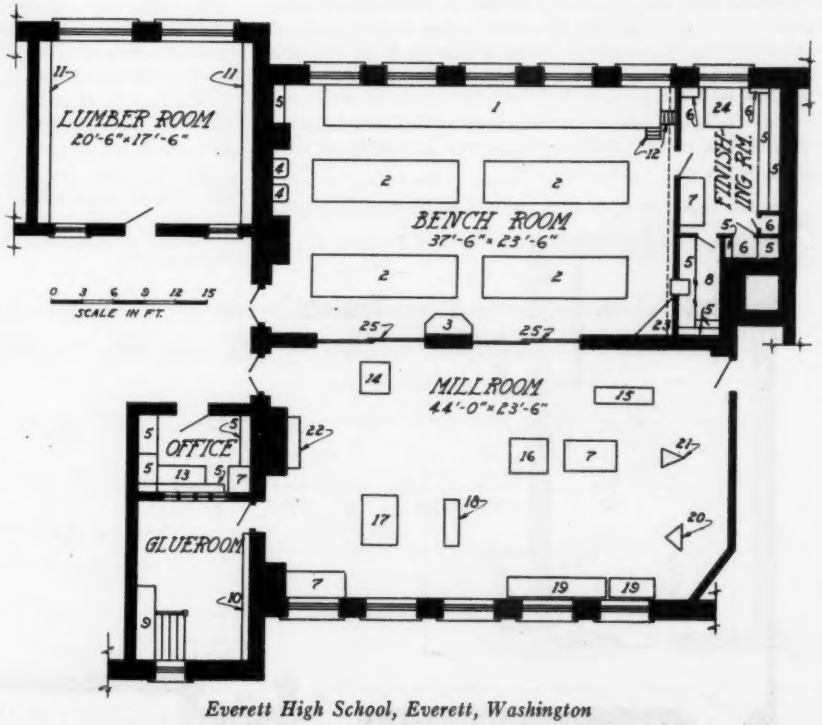
The elective system in the high school also permits the boys to elect academic subjects, mathematics, science, and other subjects which will admit them to college engineering courses. Several graduates from the carpentry class, in this way, have later on taken up construction engineering. In the same way, electrical graduates have taken up electrical engineering.

For practical work in auto trade, automobiles of practically every make are brought into the school shop. No labor charge is made, but an "overhead" charge of $1 is placed on all major jobs. Owners pay retail prices for all parts, thus giving the school a margin of profit. This makes it possible, except for equipment, to finance this department without material aid from the school district. School funds are not involved in the collection or payment of bills for parts. This is done entirely through the vocational director's office.

The shop is organized and run as nearly as possible the same as any commercial garage. The reference books used are Dyke's *Automobile Encyclopedia,*[9] *Automotive Trade*

[8] *The Cadet System of Ground School Training in Aviation,* by Lieut. Leslie Thorpe. Aviation Press, 580 Market St., San Francisco, Calif.

[9] Dyke's *Automobile Encyclopedia.* A. L. Dyke & Co., St. Louis, Mo.



Everett High School, Everett, Washington

1. Cabinet 4 ft. high with 36 Lockers
2. Benches with 10 Lockers in each
3. Emery Wheel
4. Sinks
5. Shelves
6. Cabinets
7. Benches
8. Toolroom
9. Steam Box
10. Clamp Rack
11. Lumber Racks
12. Stairs to Balcony over Finishing and Toolroom
13. Desk
14. Planer
15. Jointer
16. Circular Saw
17. Band Saw
18. Combination Saw
19. Lathes
20. Trimmer
21. Mortiser — Vertical
22. Glue Heater
23. Jig Saw and Router Bench
24. Spray Gun Cabinet
25. Sliding Doors

Electric Shop, Senior High School, Everett, Washington

Training, by Kuns,[10] *Automotive Service*, by Kuns,[11] *Analysis of the Automobile Trade*, by Dr. Small,[12] and various service manuals and charts supplied by manufacturers.

There are three or four boys who graduate from the auto department every semester. It is customary for the school to place these boys in industry for half days, during the shop period throughout their last semester. Under this coöperative plan, industry gets the boy's service for the amount of the state insurance fee and the boy gets the training on the job, his high-school credit, and a job after graduation at which he will earn his living.

Electrical-trade students are selected from the elementary group in electricity in much the same way as that in which the auto-trade students are selected.

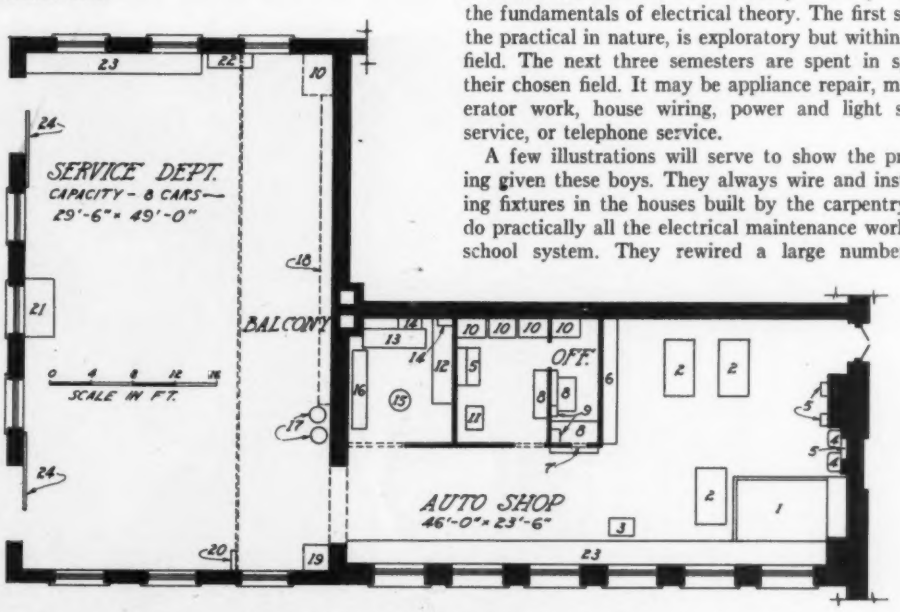
In the one hour of related study the boys are trained in the fundamentals of electrical theory. The first semester, even the practical in nature, is exploratory but within the electrical field. The next three semesters are spent in specializing in their chosen field. It may be appliance repair, motor and generator work, house wiring, power and light service, radio service, or telephone service.

A few illustrations will serve to show the practical training given these boys. They always wire and install the lighting fixtures in the houses built by the carpentry boys. They do practically all the electrical maintenance work for the city school system. They rewired a large number of motors

[10] *Automotive Trade Training*, by Ray F. Kuns. The Bruce Publishing Co., Milwaukee, Wis.

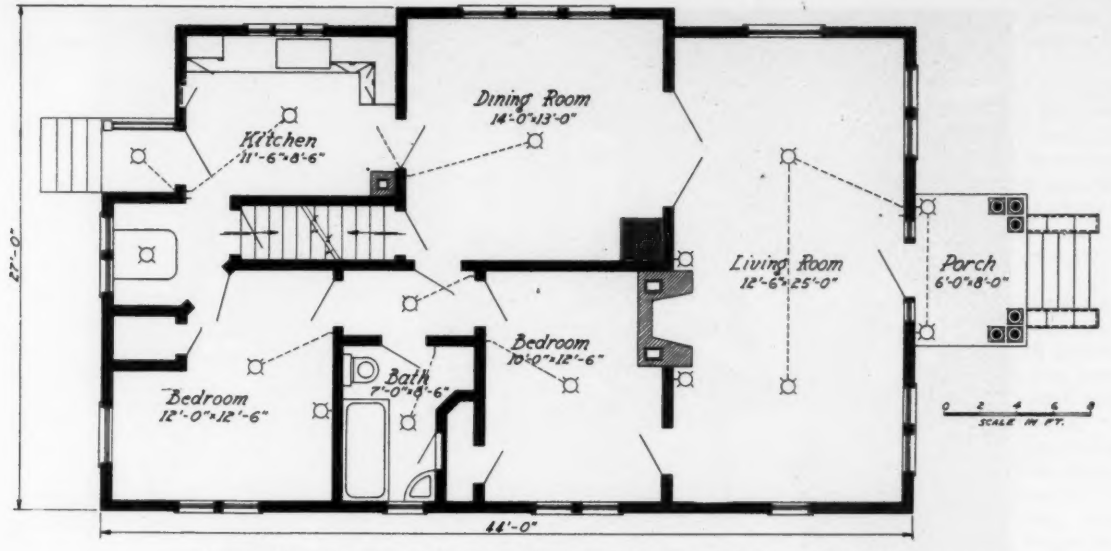
[11] *Automotive Service*, by Ray F. Kuns. The Bruce Publishing Co., Milwaukee, Wis.

[12] *Analysis of the Automobile Trade*, by Dr. R. O. Small, Director of Vocational Education, Boston, Mass.



Everett High School, Everett, Washington

1. Battery Repair Bench
2. Motor Test Stand
3. Emery Wheel
4. Wash Rack
5. Cabinet
6. Lockers
7. Office Counter
8. Office Desk
9. Filing Cabinet — Records
10. Supply Cabinet
11. Electric Welder
12. Valve Refacer
13. Lathe
14. Tool Shelves
15. Bolt Rack
16. Air Compressor
17. Air Tanks
18. Tool Racks on Balcony
19. Dumb Waiter for Tools
20. Ladder to Toolroom on Balcony
21. Crane
22. Acetylene Welding Outfit
23. Bench
24. Sliding Doors



House Built by Carpentry Students, Everett High School, Everett, Washington

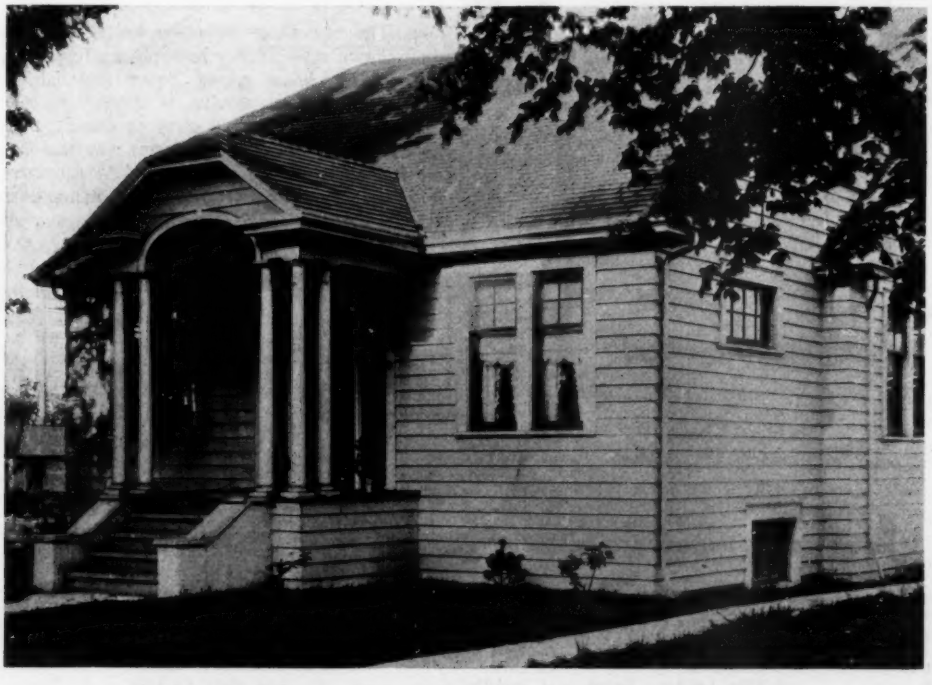
which went through a fire in one of the industrial plants. They built a short-wave broadcasting set and are licensed to transmit on meter bands of 40 and 80 meters under the call number W7RK, between 9 a.m. and 5 p.m., Pacific Standard Time. This class, coöperating with the city department of safety, installed two automatic, electrically operated traffic signals on the street between the high-school buildings. They also built an interroom telephone system in the vocational building.

They planned and installed the public-address system now in use in and among the various high-school buildings. The old broken-down house-telephone system was rebuilt and used for this purpose. Wires were strung, loud-speakers connected and all were attached to the main panel in the principal's office. The principal broadcasts his instructions to all rooms at the same time each morning. He can talk to any or all rooms at will. Any or all rooms can receive any radio program from any station at any time. These boys do many jobs for school patrons and other citizens of the community, such as rewire a house or a room or a garage, install convenience plugs, wire chicken houses, and many other jobs.

With the coöperation of the local power and light company, telephone company, and certain local contractors and dealers, the school is able to place most of the graduates through the coöperative, part-time plan. After graduation, most of these boys become regular employees of the firms with whom they had coöperative relationships before graduation.

The city of Everett has 14 houses which were built by the carpentry class of the high school. There are almost as many garages, a few school portables, a large school play shed, and a large office building.

Neither the school nor the department is involved financially in any of these building projects. The owner furnishes the lot and pays for the material according to his own



Built by the Carpentry Class, Everett High School, Everett, Washington

arrangement with the lumber dealers. The boys get the building license, stake off the lot, build cement forms, and perform all work coming within the carpentry trade. All other labor is hired by the owner, but all work is done under the direction of the school. This includes excavating, pouring concrete, lathing and plastering, bricklaying, plumbing, and painting. The electrical work is done by the school. There is no charge for student labor. This item frequently amounts to between $600 to $800. The school must be convinced that the owner is in the position to appreciate free labor and that the building will be used for his own home and not for speculative purposes.

The plans are drawn at school and approved by the owner. Any changes that are made after approval must be made through the director's office. In 1926 one of our houses was used for the model house for demonstration during "Better Homes Week."

Each year there is a large amount of work done for the school district by boys. This represents many dollars in money actually saved the school. It is necessary, practical work that must be done by hired labor unless the boys do it. However, it is done because of the practical, educational value which the work possesses, and not because of money saved. Last year, at a conservative estimate, this saving amounted to more than $1,300. Among other things, there were repairs to the steam engines of the various heating plants, fuel conveyors, broken seat castings were welded, a small school building was built, and much school furniture, such as bookshelves, sewing tables, library tables, bookcases, filing cabinets, and trophy cases was repaired. Several electric motors used in heating plants also were rewired. Old school buildings were completely rewired.

During one week in each year the value of home repair-work is stressed. Each boy in the city taking shop, takes home with him a list of jobs, some of which may need to be done in his home. He checks the list with his parents and receives instruction from his teacher as to the proper procedure. After the jobs are done, the lists are signed by parents, after which the boy gets credit or recognition for the work.

In this way the boys are able to put into practical use some of the things they have learned in the shop and at the same time the parents get some of the things done that need to be done at home. This work may be sharpening kitchen knives, the repairing of a leaking roof, the refitting of cabinet drawers, or the refinishing of a piece of furniture.

Under this plan, the school is able to tie up more closely in a practical way to the home. It helps to sell shopwork and to keep it sold to the parents.

The Work in Peoria, Illinois

L. P. Elliott

Supervisor Industrial Education,
Peoria, Illinois

This article shows how the work in industrial-arts and vocational education is organized and conducted in a city with a population of approximately 106,000.

IN describing the program for vocational and industrial-arts education for the Peoria schools, there is one factor which influences the work very strongly and which is not usually mentioned in descriptions of this kind. That factor is the policy followed in financing the school system. On account of this influence and the effect brought about, it may be well to state this policy briefly.

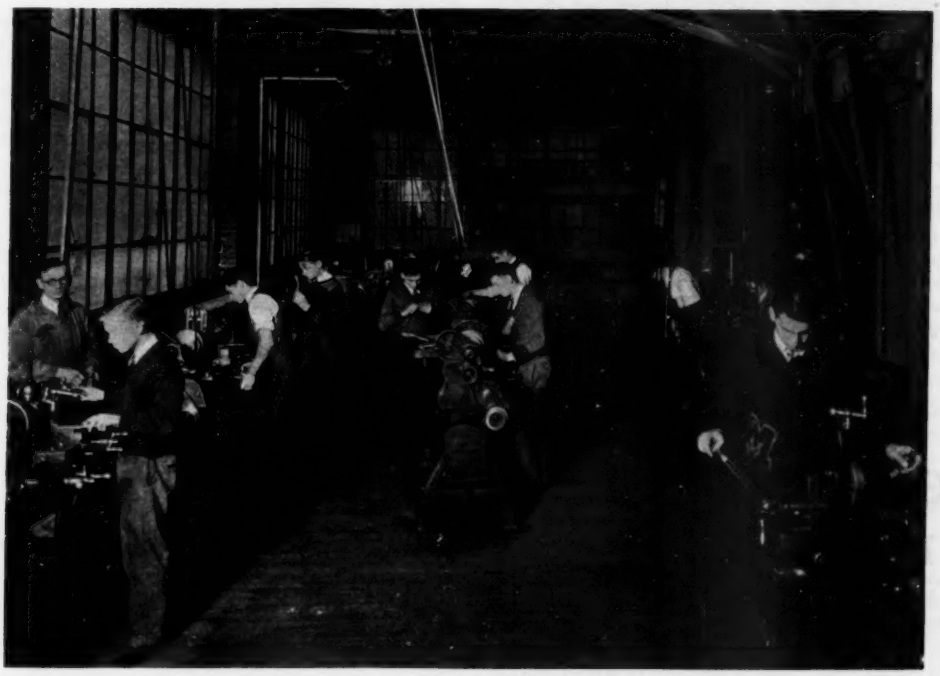
For the past ten years the Peoria schools have run on a carefully laid-out budget and have always lived within the funds available for the year. During this ten-year period, four

A Seventh-Grade Shop, Blaine-Sumner School, Peoria, Illinois

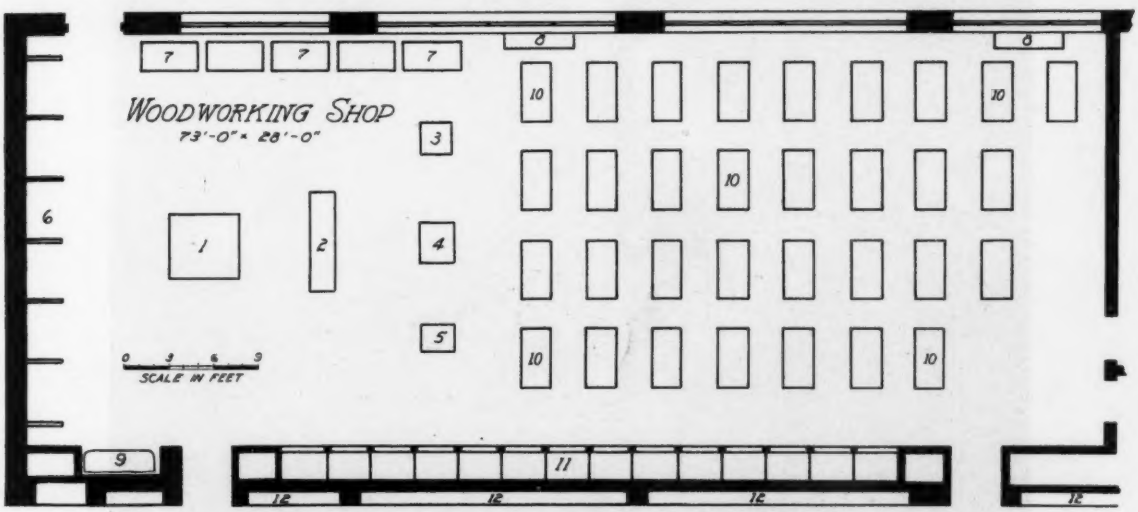
new school buildings have been built and paid for in full upon acceptance. No outlay is made in either the building or educational fund until the cash is on hand to pay the bill. During this ten-year period there has been an approximate 20 per cent increase in enrollment. With this financial background in mind it can readily be seen that the industrial-education program has necessarily been of a conservative nature. Only well-tested courses for which there is a definite demand, and which can be given without incurring too great an expense can be offered. This program forced the dropping of some courses a number of years ago where the cost seemed to exceed the results obtained. At the time, the loss of the weak classes seemed a backward step, but with the present depression facing the country it was, perhaps, fortunate that they were cut off at that time. With classes full to the limit and a waiting list in some places it is not probable that industrial education will be subject to further curtailment.

The School Organization

Until last September all schoolwork in the city was organized on the eight-four plan, there being 22 grade schools and three four-year high schools. A junior-high-school building (the first of three to be built in the next ten years) was completed and opened in September. Another junior high school was temporarily opened at the same time in an old grade-school building. This means that at present there are some grade schools with eight grades, some with seven, and several with only six grades. One junior high has seventh, eighth, and ninth grades. One high school has the tenth, eleventh, and twelfth grades, while the two others have four-year courses.



Machine Shop, Peoria Manual Training High School, Peoria, Illinois



Theodore Roosevelt Junior High School, Peoria, Illinois

1. Circular Saw
2. Jointer
3. Grinder
4. Band Saw
5. Mortiser
6. Lumber Rack
7. Lathes
8. Univents
9. Sink
10. Benches
11. Tool and Storage Cases
12. Lockers in Corridor

This gives a badly mixed program at present but eventually a six-three-three plan will be adopted for the whole city.

The Industrial-Education Program

The program for industrial education includes the following divisions:

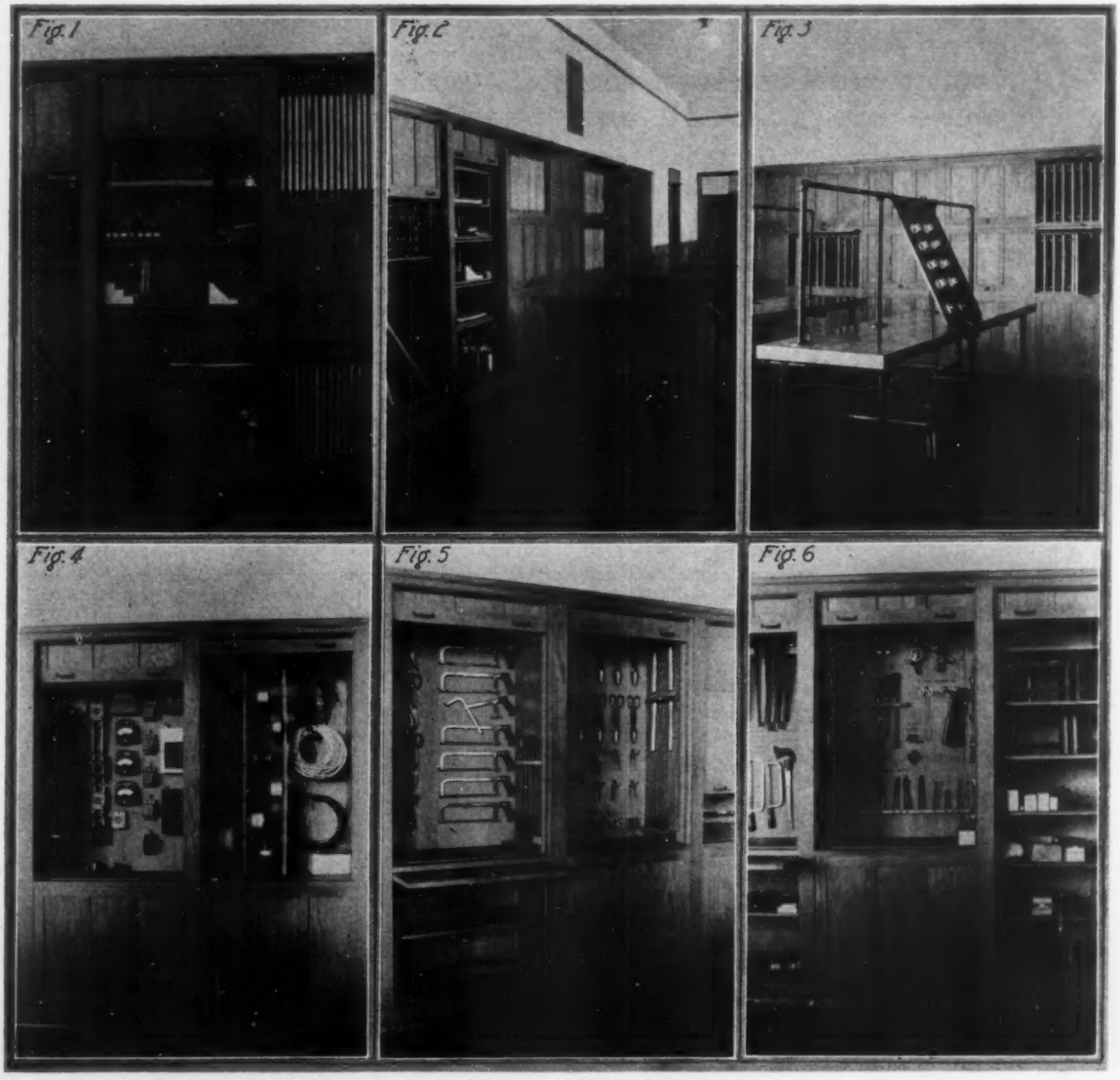
1. Shopwork one and one-half hours a week for all seventh- and eighth-grade boys in the grade schools.
2. Two clock hours per week shopwork for all seventh-, eighth-, and ninth-grade boys in junior high school.
3. Also four hours per week additional shopwork for ninth-grade boys in the junior high school who elect this work.
4. Regular high-school industrial arts cover: wood turning, machine shop, mechanical drawing, machine drawing, cabinet work, and architectural drawing.
5. A vocational full-time class in sheet-metal work is organized as a part of the high-school program in one high school.
6. Evening vocational classes for electricians and for metal workers also are offered.

The Aims of the Work

The work that is vocational in nature is approved for Smith-Hughes aid. The balance of the work is of the customary industrial-arts type. The aims for this work are to give: (*a*) as wide an acquaintance with materials as possible, (*b*) a good mechanical training in whatever medium used, and (*c*) an appreciation of the value of accurate work. It is recognized that there should be a greater variety of industrial work available for the boy to choose from, but this, at the present, must be confined to the use of the equipment on hand.

The Roosevelt Junior High School

A detailed description of the industrial-arts work and of the equipment in this school is, perhaps, fitting because it represents what the Peoria school system hopes to have for the whole city within the next ten years. School was opened in the building on September 1 with a few workmen still engaged on the finishing touches. It was formally accepted on

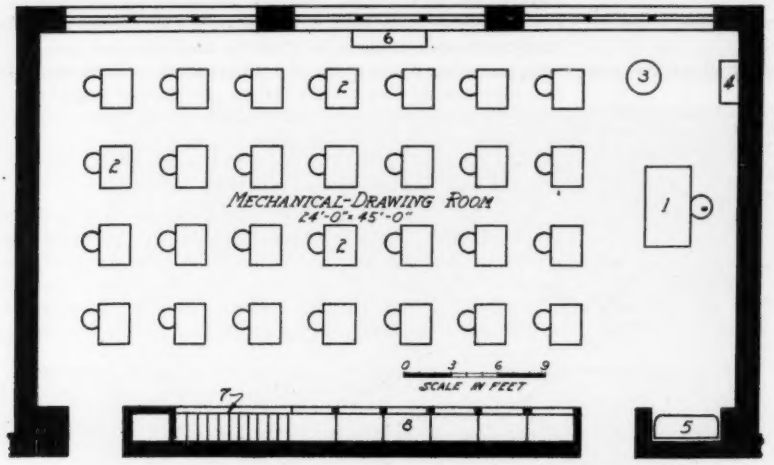


Figs. 1 and 2 show the storage cabinets as adapted for drafting room use. Figure 2 also gives a view of the drafting tables described in this article.

Figs. 3 and 4 show the storage cabinets in the electrical room. Figure 3 depicts the electrical table and the board described in this article.

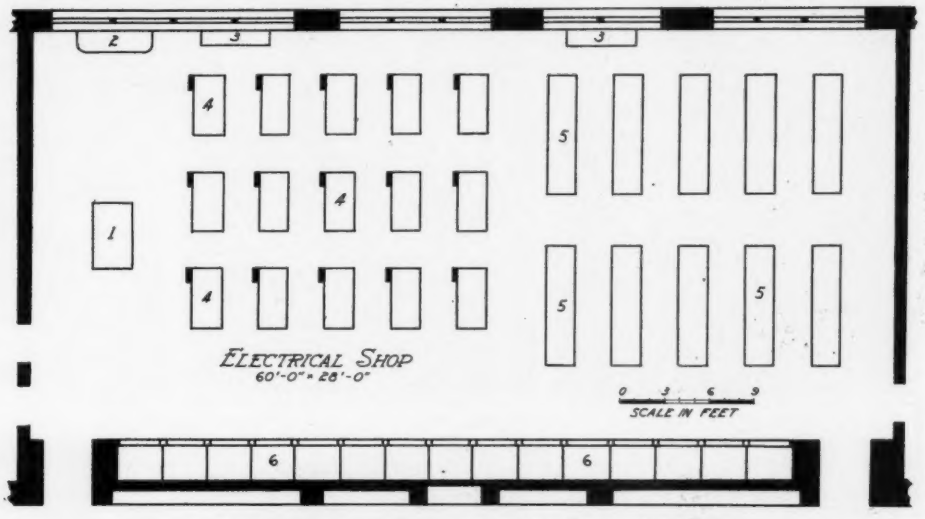
Fig. 5 shows the tool storage cabinets in the metal working shop and Fig. 6 shows how the cabinets are used in the woodworking shop.

September 30, 1932, and a check for all unpaid bills was handed to the contractor at that time. The original plans were for a building to house fifteen hundred pupils, but when it became apparent that the cost would exceed the actual funds available the size was cut to twelve hundred capacity with opportunity to increase to the full capacity by a later addi-



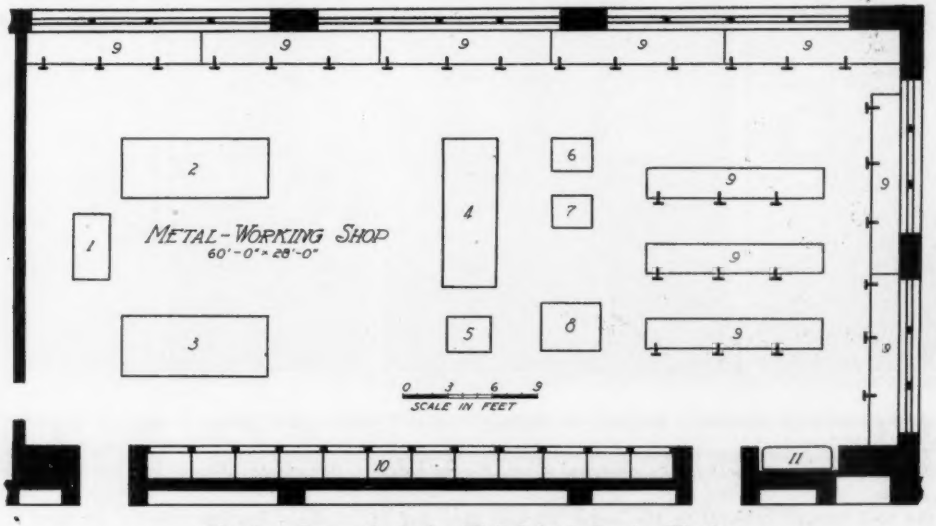
1. Teacher's Desk
2. Drawing Tables
3. Blue-Print Machine
4. Sheet Washer
5. Sink
6. Univent
7. Cases for Drawers
8. Storage Cases

Theodore Roosevelt Junior High School, Peoria, Illinois



1. Teacher's Desk
2. Sink
3. Univent
4. Benches with Vise
5. Electrical Benches
6. Storage and Tool Cases

Theodore Roosevelt Junior High School, Peoria, Illinois



1. Teacher's Desk
2. Layout Table
3. Sheet-Metal Tools
4. Soldering Bench
5. Melting Furnace
6. Drill Press
7. Grinder
8. Hand Drill Presses
9. Machinists' Benches
10. Storage and Tool Cases
11. Sink

Theodore Roosevelt Junior High School, Peoria, Illinois

tion. Where only part of a junior high school is completed, the usual procedure is to build classrooms and leave the gymnasium, auditorium, or the industrial arts, or, perhaps, all of them for a future time. The opposite was done in the case of this building. One tier of classrooms was left off and the original plans for the special subjects was carried out. The industrial-arts section has three shops, a mechanical-drawing room, and a demonstration room. The general shop was considered in making the plans for the building but the idea did not appear as feasible as four lines of work, each in a separate room with the students passing through them all. Mechanical drawing, woodwork, electricity, and metal work were selected as the four subjects most desirable in the community this school is to serve. The supervisor of industrial education and the shop teachers were given an unusual opportunity by the architects to take part in the planning of this unit. All the shops are planned to handle classes of thirty boys at a time. The accompanying floor plans give the equipment and the layout. There are three items in the equipment which are new and which may be of interest to anyone considering plans for a new group of shops. They are:

1. The tool case and storage arrangement.
2. The electrical bench.
3. The mechanical-drawing table with its opening to take the individual drawer from the storage case.

Tool Cases and Storage Cases

In planning these cases with the architect the following general standards were set up for all the shops: First, that there should be no exposed tops to collect rubbish and dirt; second, that no doors, when opened, should extend out in the aisle to interfere with passage of the students; third, that all cases be of a uniform size and so planned that they could be assembled complete at the mill. The first was accomplished by thickening the wall to take the cases and an expanded metal lath and plaster drop was hung from the ceiling to the outer edge of the row of cases. To meet the second standard, all full-length doors to cases were made to slide up behind the drop wall and all smaller storage doors pull out and slide back in the top of the case. The thickening of the inner wall of the building to take the cases also allowed the outer doors into the corridor to be hung so, when opened, they do not extend either into the corridor or into the room. For the third standard, a uniform size of 3 feet wide and 6½ ft. high for all cases was adopted. Each case was assembled as a complete unit at the mill and then set into its place in the wall and fastened. When the complete row of cases was set, a facer molding was run along the top, a baseboard at the bottom, and an edge cover between cases. The interior design of the cases was varied as follows:

a) A full-length open case for storing long work.

b) A three-unit case for storage, the units being one above the other.

c) A full-length case with adjustable shelves for books, etc.

d) A tool case with the lower third a unit as in (*b*) and the upper two thirds open for tool storage.

e) A case divided as in (*b*) and with guide strips to take electric-wiring boards, the boards being spaced 3 in. apart to allow for bells, buzzers, sockets, etc., that may be mounted on them.

f) The same type of case with guide strips to take mechanical-drawing boards.

g) A case for mechanical drawing without front door and fitted for rows of twenty small drawers. The top drawer in each row locks the row and the key is carried by the instructor. These individual pupil drawers are taken from the case by the pupil when he enters the room and placed in the drawer opening in the drawing table.

The Electrical Bench

In planning for an electrical workbench for thirty boys it became apparent that it would require an unusual amount of wiring to equip thirty single benches with outlets for both low and standard lighting voltage. On this account, a bench for three boys was designed. Two conduits come through the floor up under each table and each has a metal box with triple outlets. The pupil uses an extension cord with plug to connect his work with the current he desires. Both the low-voltage and the 115-volt connections are controlled by switches in the instructor's office so that either or both may be locked off. The bench is made entirely of pipe and pipe fittings except for the 2¼ in. maple top. The boards for mounting problems are 22 by 30 in. and have two iron hooks riveted to the top which hook over the top rail of the bench when in use. The storage case has been built to hold 210 of these boards.

The Mechanical-Drawing Table

While this table is smaller than those used in the senior high schools it seems to be adequate. The floor space was somewhat limited so the table was designed as light and small as possible. The drawer opening does not have a drawer in it except when the table is being used. Each pupil has an individual drawer which is in the storage case except when in use.

In bringing this article to a close it might be said that there is a feeling among our shop teachers that the Roosevelt shops furnish a good illustration of how adequate equipment and storage space make it possible for a teacher to handle larger classes.

Lighting the School Shop

The School-Shop Lighting Problem

Walter Sturrock

Illuminating Engineer, Nela Park Engineering Department, Cleveland, Ohio

Removing eyestrain is the best way of combatting visual handicaps. This article contains easily understood and readily applied rules that will be helpful to the schoolman.

LIGHT of a sufficient quantity and of proper quality, free from glare and harsh shadows, is an essential for all work places. The school workshops are interiors in which good lighting has a very definite control over the operations being performed. In these rooms well-designed lighting not only aids the student in doing better work because he can see detail, but also permits him to work with greater ease and minimum eye fatigue only possible where good lighting obtains.

Present-Day Conditions

Bulletin No. 7 of the Eyesight Conservation Council states: "Simple visual acuity tests reveal that 25 per cent of the school children in the United States have manifest defects of vision and symptoms of eyestrain. The work in the public schools is confined almost entirely to this preliminary examination and is at best but an approximation and admits only of the selection of cases most seriously handicapped."

As an indication of the extent of defective vision and its correction among students, the following table was compiled from reports by school authorities of 34 large cities in 18 states on 483,154 public-school children and on 46,751 students in 39 normal schools, universities, and colleges.

	Defective	*Corrected*	*Uncorrected*
Public Schools	22 per cent	13 per cent	9 per cent
Colleges	40 per cent	18 per cent	22 per cent

These reports also indicated that for children 5 or 6 years old the percentage having defective vision is probably not over 5 per cent, while for those graduating from high school at least 25 per cent have defective vision. It is evident, therefore, that in getting a public-school education, at least one student out of every five will also acquire serious eye defects. Defective vision not only handicaps a person throughout his entire life but also places an extra burden on him during his periods of study. In addition, this extra burden may so handicap a student that he requires a year or two more than prescribed to complete his course.

This is found to be the case as shown in Bulletin 7 of the Eyesight Conservation Council which states: "If each of the six million retarded children in the United States were forced to drop back only one year the cost to the country would be $390,000,000. The public-school system spends this amount each year in order that those children may have one or more years to complete their education. At least one third of this amount, or $130,000,000, is lost annually because the eyesight of the children is neglected. And, after all, this large amount is but a small part of the total loss to the child and to the state when consideration is given to the future efficiency, lowered earning power, and less competent service of the individual as an economic unit of society."

Eyestrain is the most common of all eye troubles and leads to more discomfort and disability than all other visual defects. Eyestrain is a by-product of modern civilization which places severe visual tasks upon our eyes. Until a few generations ago the principal use of our eyes was for distant vision out of doors under hundreds or even thousands of foot-candles of illumination. In contrast, humans now perform close visual operations which are principally carried on indoors under intensities only a small fractional part of those under which the eyes developed.

Unfortunately, for the well-being of the eyes, they continue to operate as best they can under all conditions of lighting. This causes nervous disorders which handicap the individual and may eventually cause suffering and disability. The elimination of these disorders has frequently been accomplished in many work areas by providing illumination of the proper quantity and quality.

Good Lighting Increases Efficiency

The action of the eye under poor illumination corresponds to the working of a camera under the same conditions — a snapshot will not take the picture; a time exposure is necessary. Add an extra fraction of a second for each time exposure we take with our eyes and in the course of a day at least a valuable half hour is lost. Ample diffused illumination makes snapshot action of the eye possible, increases the worker's efficiency and reduces ocular fatigues. More and better lighting makes visual work easier and thereby converts into useful work a greater part of the human energy available for work. The foregoing discussion not only applies to people with normal vision but also to those with subnormal vision. As a matter of fact, subnormal eyes receive greater benefits from better lighting than do the normal eyes. The results given in the following table were obtained by raising the levels of illumination from 3 to 12 foot-candles and are typical of the benefits of better lighting.

Observations Made on Several Groups	*Increase in Seeing Efficiency When Illumination Was Quadrupled*
1. Those with better eyes	14 per cent
2. Those with poor eyes	22 per cent
3. The fast workers	28 per cent
4. The slower workers	40 per cent

These test results demonstrate that lighting acts as an agent toward balancing the inequalities in the performance of the human machine, or good lighting helps those who need help most.

It should be mentioned that the complex visual operation called "seeing" is a partnership of two essential factors—vision and lighting. Eyes capable of vision are obviously necessary, but without light the most perfect eyes are useless. The principal control over vision is the application of lenses to sharpen and otherwise put it in the best condition. With the other partner, lighting, which can be controlled in quantity, diffusion, color, and distribution, lies the greatest opportunity to pro-

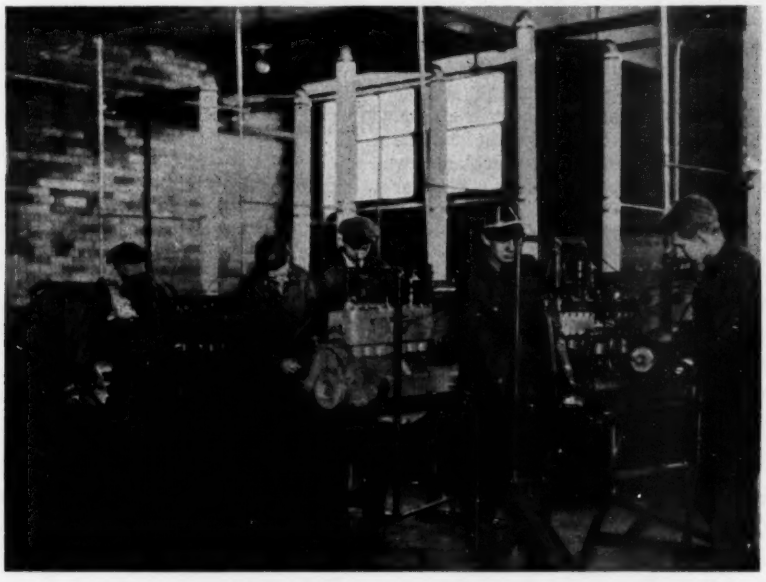


Fig. 1. Natural daylight when available cannot be surpassed; when it fails, however, artificial illumination must be used to guide the hands of these novice mechanics. Bare lamp installations are wasteful, inefficient, and hazardous.

mote better seeing. If one regards school lighting in its broader scope it may readily be seen that good illumination costs less than nothing if it eliminates the retardation of only a few of the total number of children with defective eyes. At the same time as it helps those with defective eyes it would also safeguard the eyes of many million more children from the ill effects caused by improper lighting.

The United States Bureau of Education shows an annual expense of more than two billion dollars for elementary- and secondary-school education. This amounts to $86.77 per pupil. Approximately half this amount is for teachers' salaries and the balance for operating and maintenance expense; of the latter expense only a very small amount goes for artificial lighting. In a typical large city the actual lighting cost per pupil amounted to 63 cents or less than 1 per cent of the total cost per pupil, and it would appear that this small expenditure for lighting is not proportional to its benefits.

Fig. 2. Artificial lighting is often required during the daytime to supplement natural lighting; otherwise "seeing" conditions would be extremely poor for those students working near the side wall opposite the windows.

Natural Daylight

With reference to natural lighting in shop areas, the greatest amount of daylight practicable should be provided. In many states there is a school-building code similar to the one in Ohio which specifies the minimum allowable glass area in the windows with respect to the floor area. The Ohio law reads as follows (Section 12600–54):

"There shall be provided not less than one square foot of glass area to each five square feet of floor area in each class, study, recitation schoolroom and laboratory and not less than one square foot of glass area to each eight square feet of floor area in each domestic-science, manual-training room or shop. . . . Tops of windows shall be placed above the finished-floor line at a height equal to not less than half the average width of the room minus eight inches. The width of the room shall in every case be measured at right angles to the source of light."

From the standpoint of natural lighting in the shops and manual-training room the minimum requirements for glass area should at least equal that given for the class- and study rooms. On the other hand, however, when the shop is lighted, and this is generally true, from windows located only in one side of the room, it is often impossible to satisfactorily light all sections of the work space with adequate illumination for all the students without subjecting some of them to objectionable glare. Under the recommended conditions of window area and room size the level of natural light found in the interior diminishes very rapidly as the distance from the window increases. It, therefore, requires a high level of illumination near the window in order to have anywhere near an adequate supply near the back wall. Investigations with a sensitive light meter reveal the fact that it is only on the brightest sunny days during the school year that adequate daylight is available to provide a satisfactory level of illumination in the school shop or drafting room (Fig. 1).

The 1931 edition of the Statistical Abstract of the United States shows that during the ten months of the school year the percentage of possible sunshine throughout our 48 states amounts to only 58 per cent. This clearly indicates that even though natural lighting is used to its practical limit throughout the school day that more than 40 per cent of the time artificial illumination is necessary to provide good "seeing" conditions (Fig. 2). On dull, dark days, such as occur during our winter months, the amount of daylight inside the room near the side wall opposite the windows is often less than 1 foot-candle. It is, therefore, evident that although natural daylight is used and should be used to its practical limit, it is also necessary to provide a well-designed system of artificial lighting which will fulfill the requirements for good illumination at all times, night or day.

Illumination Levels

The levels of illumination recommended for school shops and drafting rooms are respectively 12 to 15 foot-candles and 18 to 25 foot-candles. The foot-candle is the unit for measuring illumination and is the average intensity found on an area of one square foot having one lumen of light on it; the lumen being the unit of quantity of light. The level of illumination obtained from any lighting system either artificial or natural can readily be measured by a foot-candle meter (Fig. 3). The accuracy of this meter is sufficient for making check tests on any lighting system; more accurate instruments are available for use in the laboratory or elsewhere, if very careful foot-candle readings must be made.

Considerations of economy limit the level of illumination employed in artificial lighting to the lower values, 10 to 20 foot-candles, instead of 1,000 to 10,000 foot-candles, the levels under which the eye evolved. With these comparatively low

Fig. 3. Foot-candle meter

levels as well as with the higher ones, the illumination must be safeguarded as regards quality; it must be free from glare and well diffused throughout the room so that there will be no extreme brightness contrasts between the surface to be viewed and its surroundings.

Glare

Glare is any brightness within the field of vision of such a character as to cause annoyance, discomfort, interference with vision or eye fatigue. Glare may come directly from the light source or it may be reflected from a glossy-surface desk top or any polished glass or metallic surface. The extent to which either direct or reflected glare is objectionable is partially dependent upon the contrast in brightness between the light source and the background. A bright light source in the center of dark surroundings is particularly annoying, while the same light source would hardly be noticed if placed out of doors during the daytime.

The automobile driver has recognized a severe example of this effect comparing the nighttime and daytime appearance of lighted automobile headlights. In interiors, the most effective way of reducing the contrast between the brightness of the lighting units suspended from the ceiling and their surroundings is to provide ceiling finishes which are, in general, light in tone rather than dark and to install lighting units of a low brightness which are designed to properly diffuse the light.

The degree to which glare is uncomfortable is also dependent upon the position of the light source in the field of view. Even small light sources, if placed directly in the line of vision, will be found very annoying unless they are properly equipped with shielding devices or diffusing media. Local lighting units on desks in the drafting room or on the machines in the shop are objectionable because they often do not entirely eliminate direct glare from the light source and even if they do, the reflected glare from glossy paper or polished metal surfaces is very annoying to the eyes.

In general, reflected glare is often more objectionable than direct glare and objects appear harsh and unpleasant. Also it is very annoying to the draftsman or mechanic to have dark shadows always present under pencils, drawing instruments, tools, etc. Exposed lamp filaments cause these harsh shadows, whereas light from a diffusing luminaire of large area tends to shine around an object and consequently softens the shadows.

Luminaires

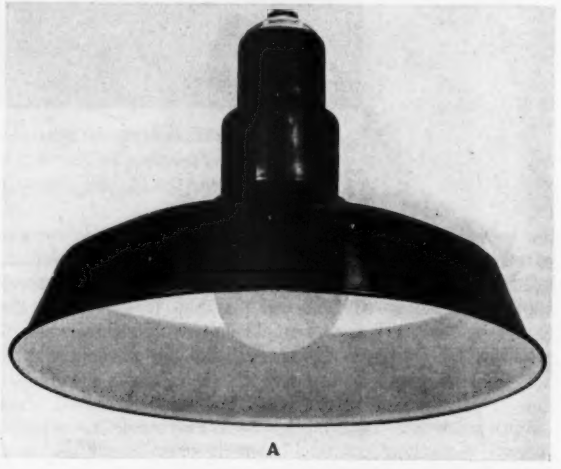
There are three general systems of artificial illumination classified to the manner in which the light is distributed; namely, direct lighting, indirect lighting, and semi-indirect lighting.

Direct-lighting systems employ luminaires which send the greater portion of light directly to the surfaces to be illuminated. Open-type reflectors and inclosing globes come under this heading. For school shops, in general, the open-type unit illustrated in Figure 4 (*a*) which shows an RLM Standard Dome enameled-steel reflector is quite satisfactory if equipped with a white bowl lamp. For best conditions, however, luminaires of a higher quality, such as found in the Glassteel Diffuser — Figure 4 (*b*) — would be recommended. This unit is a combination of the porcelain enameled-steel-dome reflector and a white-glass inclosing globe. The downward rays of light are diffused by the white-glass globe which completely incloses the lamp. Slots in the top of the reflector allow a small part of the light to be emitted upward, thus partially illuminating the ceiling and generally improving the appearance of the lighted room. The reflector also reduces glare by hiding a large part of the bright area of the globe. This type of lighting unit is most highly recommended for metal and woodworking school shops.

Indirect and semi-indirect lighting systems utilize the ceiling and upper side walls for redirecting and diffusing the light throughout the room. Figure 5 illustrates these types of lighting units. Since the ceiling acts as the light source, glare from the unit is avoided, and heavy, dense shadows are eliminated. For drafting-room work the illumination must be free from bright light sources and it must be well diffused in order to eliminate shadows from the pencil, T square, triangles, etc. Indirect and semi-direct types of units best fulfill the requirements for lighting the mechanical-drawing rooms.

Location of Outlets

Fairly definite relations exist between the height at which lighting units are mounted above the work and the distance



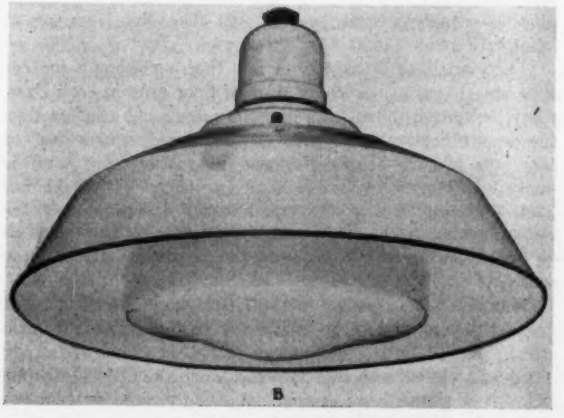


Fig. 4. Types of porcelain enameled steel reflectors. (A) RLM Standard Dome with white bowl lamp. (B) Glassteel Diffuser with clear lamp.

by which they may be separated to provide uniform illumination, with the light coming from a sufficient number of directions so that shadows will not prove troublesome. However, the actual location of outlets is somewhat controlled by the structural features of the interior. Cross beams and supporting columns as well as the ceiling height must be considered.

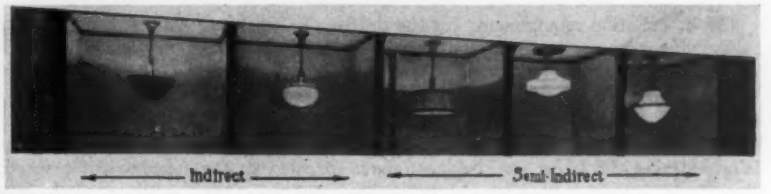


Fig. 5. Totally indirect and semi-indirect lighting units.

For the ceiling heights most generally found, namely, 10 feet to 14 feet, the maximum distance between lighting units should not exceed the height of the ceiling. A closer spacing is beneficial and often desirable; on the other hand, a wider spacing is not recommended because the illumination midway between units falls off rapidly.

Fig. 6. Glassteel Diffuser units in this woodworking shop provide comfortable well-diffused illumination free from glare and harsh shadows. The units are spaced on 10 by 10 ft. centers and provide 16 foot candles of illumination.

The usual layout of machines and workbenches in school shops places the work areas near the side walls. In order to properly light these work areas it is necessary that the first row of outlets be located out from the side wall at a distance not greater than one third the spacing distance between rows. This same rule should be followed in the drafting room in the event drawing boards are located close to the wall. In the usual case, with aisles along the side walls, it will be found satisfactory to locate the first row of outlets out from the wall at a distance not exceeding one half the spacing distance between rows.

Size of Lamp

It has already been pointed out that 12 to 15 foot-candles of artificial illumination should be provided in the school shop and that this illumination should preferably come from lighting units of the Glassteel Diffuser type (Fig. 6). Assuming a small shop having a floor area equal to the usual size of a class or study room (24 ft. wide and 30 ft. long with a 12-ft. ceiling height), it will require six outlets if aisles are near the walls and nine outlets if workbenches are located near the side wall. In the former case the outlets would be spaced on 10 by 12-ft. centers and 300-watt Mazda lamps in Glassteel Diffusers would be required to provide 13 foot-candles of illumination. If RLM reflectors are used instead of Glassteel Diffuser units the illumination would be slightly higher but not as well diffused and free from glare as found from the latter. If workbenches or machines are placed near the side walls then nine outlets should be installed located on about 9 by 10-ft. centers with the first row of outlets 3 ft. out from the side walls. With this layout of outlets, 200-watt Glassteel Diffusers would provide about 12 foot-candles.

In general, for school-shop rooms where from the spacing-ceiling-height rule it is found that six outlets or more must be installed in order to provide a fairly even distribution of illumination, the recommended lamp sizes are as follows:

1. Where the average area per outlet is 80 sq. ft. or less — 200-watt.
2. Where the average area per outlet is 81 to 120 sq. ft. — 300-watt.
3. Where the average area per outlet is 121 to 190 sq. ft. — 500-watt.

In connection with the main shop areas there are often smaller rooms, such as the finishing room, where in following out the spacing-ceiling-height rule it is found that four outlets are sufficient for the lighting. In this case the lamp sizes would be as follows:

1. Where the average area per outlet is 60 sq. ft. or less — 200-watt.
2. Where the average area per outlet is 61 to 95 sq. ft. — 300-watt.
3. Where the average area per outlet is 96 to 150 sq. ft. — 500-watt.

Fig. 7. With an average area per outlet of approximately 65 sq. ft. the 300-watt totally indirect lighting units provide an illumination in service of 18 foot candles for this drawing room.

The illumination requirements for the drafting or mechanical-drawing room are somewhat more critical than those for the shop areas. Higher levels of illumination are not only desired but also more highly diffused illumination, such as obtained from the less efficient indirect and semi-indirect types of units, should be provided. These combined requirements necessitate lamp wattages of a larger size than that above specified for the shop areas. Figure 7 illustrates a well-lighted drafting room where 300-watt Mazda lamps are used in totally indirect-lighting units. In general, in drafting rooms where six outlets or more are required from the spacing-ceiling-height rule, the recommended lamp sizes are as follows:

1. Where the average area per outlet is 70 sq. ft. or less — 300-watt.
2. Where the average area per outlet is 71 to 100 sq. ft. — 500-watt.
3. Where the average area per outlet is 101 to 150 sq. ft. — 750-watt.

Drafting rooms smaller than the six-outlet room are seldom found in a vocational school. However, when they are used the ratio between wattage size of lamp and average square foot of area per outlet should be slightly greater than that indicated in the foregoing specifications. This increase in ratio is desired to offset the decrease in per-cent utilization of light in smaller rooms.

Maintenance and Adequate Wiring

In planning the lighting system for school buildings, some forethought should be given to its proper maintenance while in service. The fact is often overlooked that lamps and reflectors become covered with dust and dirt which very materially reduces the light output. As a result, good illumination systems depreciate rapidly and complaints are received on the low levels of lighting.

Every lighting system should, therefore, have a well-planned maintenance schedule whereby the units are cleaned periodically at such intervals that no appreciable amount of dust and dirt will be allowed to collect. It is also important that the ceilings and upper side walls be fairly light in tone if these surfaces are depended upon to any extent for reflecting light. In this case they must be cleaned or repainted at least once every two or three years.

In general, maintaining the lighting system implies a procedure that will cause normal, satisfactory operation. In a broader sense, however, maintenance includes changes or extensions in the electric-wiring system to meet the demand for an increased load in certain sections of the building.

In planning a new school building the initial wiring system should be designed, not only to properly distribute the immediate load of electrical energy throughout the interior, but also to possess sufficient capacity to meet, to a reasonable degree, the probable increasing needs of the building for a few years to come. From this point of view, lighting-maintenance problems may be fairly simple or extremely difficult and uneconomical depending upon the care taken in selecting the proper size of wire, conduit, panel boards, and switches, as well as the proper location of outlets and lighting units for the initial installation.

Shop Subjects

For shop layouts see pages 36, 37, 38, 39, 42, 44, 62, 63 and 64. For equipment and supply check lists see pages 72, 93, 102, 106, 110, 117, and 122

Woodworking Equipment

Orville A. Tearney

Director of Industrial Arts, Southeast Missouri State Teachers College, Cape Girardeau, Missouri

This study of existing conditions relative to shop equipment in the woodworking departments of 155 junior high schools was made to determine what might be called adequate equipment.

THERE has been much discussion about underequipment and overequipment. Nobody knows just exactly what adequate equipment embraces. The purpose of this part of the study of shopwork is to point out the limitation and extent of tool equipment used for teaching woodwork in 155 junior high schools widely separated.

Benches

No part of the equipment is used more constantly than are the benches. The number of single benches designates at once the maximum number of pupils to be accommodated during a class period. The range as to the number of benches occurring in shops is large, as will be shown in the discussion immediately following.

Column 2 of Table I, items 2 to 48, shows that of the junior-high-school shops studied, only one has as few as 2 benches, and only one has as many as 48 benches. Between these two extremes there is a wide variation. The factors determining the amount of equipment possessed by a junior high school are many. The chief ones are, however, (1) the size of the school, (2) the wealth and progressiveness of the community, (3) the training of school officials, and (4) the organization of the curriculum.

However varied the number of benches possessed, there is, nevertheless, a decided central tendency. Referring again to Table I, items 20, 21, 22, 23, and 24, show that there are 26 shops that are each equipped with 20 benches; 38 shops each equipped with 24 benches; and 16 shops with numbers in between. This means that 80 of the shops studied are equipped with a number of benches ranging from 20 to 24, inclusive. In short, more than half of the shops studied are equipped with a number of benches ranging from 20 to 24, inclusive.

Hand Tools

In ordinary shop organization there are two groups of tools, which are designated individual tools and general tools. Individual tools range from about four to ten in number and are used by only one pupil during a given period. They are usually kept in an orderly fashion in a locker located in the bench. General tools constitute a more varied number, and are kept in a systematic manner on a large wall tool rack or in a toolroom. General tools, as the name indicates, are for general use; that is, any pupil may go to the rack and get one, returning it to its proper place as soon as it has served its purpose. With this system, several pupils may use the same tool at different times during the same period.

A shop may be so organized as to use either the individual system or the general system. Most shops are organized, however, so as to use a combination of these two systems.

An interesting picture concerning tools is given in Table II. The oilstone and T bevel are the least prevalent as individual tools. The try-square, a testing tool, is the most prevalent. The rule, of course, is needed frequently, and hence, is a part of the individual set in most cases. The backsaw tends to be an individual tool in practice while the crosscut saw tends to be a general tool. The ripsaw is decidedly a general tool. A jack plane is supplied for each pupil in most sets. The smoothing plane is likely to be found on the rack in the general toolroom. The ¼-in. chisel is grouped as an individual tool in slightly more than half of the schools studied with the ½-in. chisel as a close second. The ¾-in. chisel is in most cases a general tool. The 1-in. chisel and the ⅞-in. chisel are decidedly general tools as are the hammer and the screw driver.

TABLE I

Number of Woodworking Benches Used in Each of 155 Junior High Schools

Column 1 Number of Benches	*Column 2 Number of Junior High Schools*	*Column 1 Number of Benches*	*Column 2 Number of Junior High Schools*
1	0	26	4
2	1	27	1
3	1	28	2
4	0	29	3
5	0	30	8
6	1	31	1
7	1	32	1
8	0	33	0
9	1	34	3
10	4	35	0
11	2	36	3
12	4	37	0
13	0	38	4
14	4	39	
15	3	40	2
16	7	41	0
17	0	42	0
18	5	43	0
19	2	44	1
20	26	45	0
21	6	46	0
22	8	47	0
23	2	48	1
24	38		
25	5	Total	155

TABLE II

Percentage of 141 Junior High Schools that Include Each of the Common Woodworking Hand Tools in Each Individual Set

Column 1 Name of Tool	*Column 2 Number of Junior High Schools Having Each Woodworking Hand Tool Here Listed in Each Individual Set*	*Column 3 Percentage*
1. Try-square	140	99.29
2. Marking gauge	127	90.07
3. Rule	123	87.23
4. Backsaw	119	84.39
5. Jack plane	114	80.85
6. Brush	113	80.14
7. Bench hook	97	68.79
8. Mallet	80	56.73
9. Chisel, ¼-in.	73	51.77
10. Chisel, ½-in.	70	49.64
11. Chisel, ¾-in.	58	41.13
12. Smoothing plane	54	38.29
13. Chisel, 1-in.	53	37.58
14. Block plane	46	32.62
15. Crosscut saw	44	31.20
16. Ripsaw	23	16.31
17. Hammer	21	14.89
18. Chisel, ⅞-in.	20	14.18
19. Screw driver	17	12.05
20. T bevel	1	00.70
21. Oilstone	1	00.70

TABLE III

Woodworking Power Machines Owned By 155 Junior High Schools Reporting

Column 1 Name of Machine	*Column 2 Number of Junior High Schools Owning at Least One*	*Column 3 Percentage*
1. Circular saw	116	74.83
2. Band saw	102	65.80
3. Jointer	93	60.00
4. Lathe	84	54.12
5. Grinder	78	50.32
6. Mortiser	34	21.94
7. Sander	21	13.54
8. Surfacer	18	11.61
9. Scroll saw	11	7.09
10. Shaper	8	5.16
11. Drill	5	3.22
12. Tenoner	4	2.58
13. Swing saw	3	1.93

TABLE IV

Of 155 Junior High Schools Reporting, Number That Were to Add to Woodworking Equipment During the Two Years Immediately Following the Collection of This Data

	Column 1 Value of Equipment To Be Added	*Column 2 Number of Junior High Schools That Will Add Equipment*		*Column 1 Value of Equipment To Be Added*	*Column 2 Number of Junior High Schools That Will Add Equipment*
1.	50.00	2	15.	550.00	2
2.	100.00	6	16.	580.00	1
3.	150.00	3	17.	600.00	2
4.	175.00	1	18.	650.00	1
5.	200.00	9	19.	700.00	1
6.	225.00	2	20.	750.00	1
7.	250.00	6	21.	800.00	1
8.	280.00	1	22.	900.00	2
9.	300.00	8	23.	1,000.00	3
10.	350.00	5	24.	1,175.00	1
11.	400.00	7	25.	1,750.00	1
12.	450.00	1	26.	2,000.00	1
13.	475.00	1		Total	76
14.	500.00	7			

Studying Table II more minutely, items 1, 2, 3, 4, 5, and 6, column 3, show that the try-square, marking gauge, rule, backsaw, jack plane, and brush, constitute the set of individual tools in more than 80 per cent of the shops studied. The conditions in this finding are likely to be based on reason rather than on accident, as the data were secured over a large area. Every section of the United States was represented.

Power Machines

Benchwork on the whole is more educative than machine work, and hence it is being taught and should be taught before machine work. Installation of bench equipment generally precedes installation of machine equipment. When funds are limited, the purchase of machines is usually indefinitely deferred.

There is, however, always a strong demand by both instructor and pupil for power machines. The instructor is desirous of enlarging the scope of his work; the pupil finds

machine operation fascinating. Therefore, as soon as the budget will permit, machine equipment is added to bench equipment.

The first machine to be purchased is, of course, the one regarded by the authorities as most valuable; and the most valuable is one which has to do with processes that are fundamental and on which a large number of operations can be performed.

The circular saw appears to be the most popular power machine used in junior-high-school woodworking shops. Reference to Table III, item 1, column 3, shows that 74.83 per cent of the 155 junior-high-school shops studied have circular saws. The circular saw is a very useful machine, and the average woodworking instructor would accept this objective fact shown in the table as very logical. The circular saw is also very complementary to benchwork because it is usually employed to cut out stock for benchwork. This tool is extremely essential where large classes are taught benchwork.

The popularity of thirteen woodworking machines is shown objectively and numerically in Table III as related to 155 junior high schools. Perhaps these facts shown in the table would not withstand a severe rationalization. For example: the grinder is ranked in the fifth place of usefulness; whereas the grinder is so extremely essential to bench toolwork, that it would seem rational to regard it as the first power tool to be purchased. Again, the band saw is ranked in second place and the surfacer in eighth place. There is no logic that would give this ratio of difference between the importance of the band saw and that of the surfacer. The local conditions and type of work to be turned out would determine the most desirable machine.

In evaluating fairly the facts given in Table III, one must keep in mind that a shop is not necessarily limited to one machine. Indeed, many shops have machines for various operations. Therefore, the ranking in Table III is not so significant for a shop possessing several machines with each being used for a different operation.

Equipment to Be Added

As stated at the outset, shop teachers think largely in terms of equipment. They are, as a rule, ambitious to improve and add to their equipment. This is a legitimate ambition and accounts largely for school shops being as well equipped as they are.

The story is told in Table IV of 76 junior high schools that will add to their equipment during the two years following the collection of the data for this study. Items from 1 to 26, inclusive, show the amounts of equipment in money valuation to be added. The range is from $50 to $2,000. One was to spend as little as $50, and another as much as $2,000. Six contemplate the spending of $1,000 or more. Forty were to spend amounts ranging from $200 to $450, inclusive, and eighteen from $500 to $900, inclusive. In short, 49.03 per cent, or nearly half of 155 junior-high-school shops studied, had planned that they would add materially to their woodworking equipment during the period indicated.

Summary

The number of benches owned by 155 junior high schools ranges from 2 to 48 with a wide variation between these two extremes. But there is a decided central tendency which shows that 80 shops, or more than half of the shops studied, own benches in numbers ranging from 20 to 24, inclusive.

Considering the make-up of individual sets of tools, the try-square is the most prevalent. The oilstone and T bevel are the least prevalent. The try-square, marking gauge, rule, backsaw, jack plane, and bench brush, are the tools occurring in individual sets in more than 80 per cent of the schools reporting. The try-square occurred in individual sets in 99.29 per cent of the shops studied, making it appear almost universal.

Approximately 75 per cent of the shops studied have one or more power machines. About 25 per cent of all the shops studied have no power machines. They confine their work to hand tools. The circular saw, band saw, jointer, lathe, and grinder, are owned by more than half of the schools reporting. The circular saw is the most prevalent power machine.

Seventy-six junior high schools, or 49.03 per cent of all that have been studied, were planning to add to their equipment during the two years immediately following the taking of these data. The amounts of money to be spent ranged from $50 to $2,000 per school.

Machine Drafting in Industry

Raymond R. Bloom

J. Sterling Morton High School,
Cicero, Illinois

An excellent analysis of the machine-drafting trade which will be found exceedingly helpful in satisfying the vocational-guidance objective of the junior-high-school drafting course.

IN THIS machine age the draftsman fills an important position in industry.

Before any machine is used, it has to be conceived and planned and built. It is with the conceiving and planning part of the work that the draftsman is concerned. It is he who makes the sketches to picture on paper what is embodied in the new idea, new design, or new patent.

From this first sketch, the draftsman then makes drawings with the aid of instruments. Upon these he places dimensions and indicates materials to be used, so that the worker in the shop knows how to construct the machine.

Requirements

Educational. It is highly desirable for a draftsman to have a high-school education in order that he may intelligently understand or read the orders given him by his superiors, write directions that can be easily interpreted by others, and make the mathematical calculations that are required by his work. Then too, a boy with a high-school education can succeed much faster in the drafting room because he usually has had drawing as a part of his high-school course. Besides this, he has received a good foundation in the sciences and in mathematics.

A knowledge of machine-shop practice, patternmaking, and foundry practice will be found a great aid in the drafting trade. Aside from making the drawing, the draftsman must know how to design the part so the pattern can be easily and quickly made, the casting readily molded, and the piece cheaply machined.

Mental. A draftsman must be quick, alert, accurate, neat, patient, loyal, and must be able to follow directions.

Physical. One must have average good health and possess good eyesight to succeed as a draftsman. However, one who has the other required qualifications but is crippled may become a draftsman providing he has the use of his arms, hands, and fingers.

Working Conditions

Place of Work. The draftsman generally has a fair place to work. It is moderately cool in summer, warm in winter, well lighted and ventilated.

The working hours are generally from 8 a.m. to 5 or 5:30 p.m. Some companies give a half hour for lunch, while others give an hour, and most of them grant a half holiday on Saturday.

Tracer: Traces pencil drawings in ink on vellum or tracing cloth. Time spent in this step is usually from six months to a year.

Detailer: Makes detail drawings of parts of machines, tools, or fixtures from sketches or from assembly drawings. Time in this step is one year at least.

Layout Man: Makes layout of drawing from designs sketched by designer. Time spent here is two years or more.

Checker: Examines drawings for accuracy of detail, dimensions, finish, heat treatment, tolerances, etc. Time spent here is three years and up.

Designer: Works out ideas of engineer from the practical standpoint of design and production. Time spent here is from four years and up.

Vacations are generally given by all companies; some give two weeks with pay, while others give two weeks without pay. There is no set rule as to this policy.

The trade is not seasonal except in the automotive industry and in some of the building operations.

The wages of a draftsman vary in different localities, but the following table gives a fair knowledge of the high and low rates in the various steps of the trade from blue-print boy to designer:

Blue-print boy,	from $13 to $15 a week.
Tracer,	from $18 to $22 a week.
Detailer,	from $23 to $30 a week.
Layout man,	from $25 to $40 a week.
Checker,	from $40 to $55 a week.
Designer,	from $60 to $90 a week.

Clean lines. The trade is clean except when a breakdown occurs the draftsman may have to crawl down into a pit to sketch or measure some broken part of a machine, pump, or engine.

Some companies require that a boy starting in the drafting trade spend a year, or at least part of a year, in the shops to work at different machines to gain knowledge of machinery or to get acquainted with a specific line of products. This is a very good method.

Hazards. The draftsman's occupation may not be so healthful because he is constantly bent over his board and his work is always indoors. The chance for accident is very slight.

Social Standing. The draftsman is a skilled worker. He, therefore, occupies a middle position between the professional man and the unskilled worker.

Source of Supply. The beginner usually starts in the blue-print room, having previously served as office or errand boy, or he enters directly from the elementary school, or part-time school, or he may come in as a tracer from the shop, or through apprenticeship, coöperative system, vocational school, or trade school. Graduates from engineering and technical schools usually start in as detailers and layout men.

Entrance Age. The average age of entrance into the different divisions of the trade are:

Blue-print boy, 16 years or older.
Tracer, 17 or 18 years.
Detailer, 19 years or older.
Layout man, 20 years or older.
Checker, 22 years or older.
Designer, 35 years or older.

There are, of course, exceptions and these ages may differ widely.

Advantages. The man in the drafting room has the opportunity of becoming an engineer or superintendent of a plant, or to invent or improve some labor-saving device and thus be in a position to start a plant or business of his own.

Disadvantages. Constant eyestrain due to glare on paper, vellum, or tracing cloth is hard on the eyes. Leaning over board continuously from day to day tends toward nervousness.

If not alert, one is apt to get into a rut with some companies.

There is a limit to advancement in wages if one does not become a good designer. Every boy that starts in the drafting trade should have the ambition to become a good designing engineer. He must, however, remember that this can be accomplished only by studying, either at evening school, or by taking correspondence or extension courses, or by attending a technical or an engineering school. He also should read such magazines as *Machinery* and *American Machinist* regularly.

Duties

Blue-print boy: Makes blue prints, cares for blue-printing machines, and files prints and tracings. Time spent in this step is from three to six months.

Care of Tools in the Metal Shop

E. L. Bowman

Columbus, Ohio

The common methods of handling this troublesome problem in the shop as well as in inventory-taking are ably discussed in this article.

TOOLS and supplies for machine shops and other metal shops are exceedingly costly, as well as extremely susceptible to damage from rust or corrosion. It is therefore essential for good instructional management that instructors in metal shops practice adequate methods of caring for tools during the school year, as well as provide properly for storage of tools during the summer vacations. Further, part of the training of boys as apprentices in trade-school shops is the development of skill and judgment in the use of trade methods of issuing, caring for, returning, and repairing tools. The following suggestions are offered to stimulate this practice and to lead toward the adoption of a practical common-sense system of caring for tools and of storing them.

Issuing of Tools

Two general methods of supplying the small tools necessary for an apprentice are followed: first, the plan of supplying a general working kit at each working place; and second, the plan of issuing all tools from a central tool crib or toolroom.

In many school machine shops the practice is followed of placing at each working place on the long bench a tray containing a center gauge, inside and outside calipers, six-inch steel scale, center punch, tool holders, bits, a hammer, a wrench, and other commonly used tools. Where this system is followed, each tool must be marked with the number of

the working place to which it belongs. When the student reports for work, his first duty is to check over the common kit of tools, and to report to the instructor on any tools that may be damaged or missing. If he does not thus report any tools missing, he is held responsible for all the tools that are supposed to be at that particular working place. Thus, if student A works at place No. 7 on Monday morning, and student B on Monday afternoon reports the loss of the center punch of the set of tools at No. 7, student A is held responsible, unless he has reported on going to work on Monday morning that student C, who used the material on Friday afternoon, had lost the punch. In like manner, if student B fails to report that the inside calipers are damaged, he becomes responsible for this item if student D, on reporting for work on Tuesday morning, reports that the inside calipers are damaged. A little care with new students soon habituates all students to the routine of reporting. Here, "no news is good news" at least in reporting lost or damaged tools.

Under the system of furnishing one set of tools to each working place, all special or occasional tools are issued from the instructor's desk or from a tool crib to which the instructor only has access. If the instructor must personally attend to the issuing of all special tools, much of his time may be taken up, especially where the group is doing advanced work.

In industry, practices differ in the matter of issuing tools. Most patternmakers carry their own kits of tools, depending on the shop for special tools only. The same is true of toolmakers. In general, skilled workmen like to have their own kits of tools. The greater the degree of hand skill, the more likely the mechanic is to provide his own set of tools.

In production work, however, practically all tools are issued from a central toolroom. The same plan is used in many school shops. In trade-school courses generally, each boy at the beginning of his course receives a number of brass checks, all stamped with the same number, which number may be the time-clock card number of the apprentice student. When the student desires a tool or a number of tools, he applies at the tool-crib window and is issued the desired tools in exchange for a similar number of brass checks bearing his number. These checks are then hung on small brads driven near the place where the issued tool is stored, so that a glance will show whether each missing tool is represented by a brass check. When the tool is returned in good condition, the brass check is returned to the apprentice who has drawn the tool.

This check system requires the presence in the tool crib at all times of some person who knows where every tool is kept, and who is responsible directly to the instructor for the care and issuing of the tools in the crib. It is usual to rotate the boys of the trade class in the position of tool-crib keeper. Some instructors object to using a boy for this purpose; but when the opportunity for learning the names, uses, care, and storage of tools is considered, it will be conceded that the advantages far outweigh the objections. To insure the proper breaking-in of the tool-crib keeper, it is common practice to keep two boys in the tool crib at rush hours, which occur at the beginning and end of each session. Of these two boys, one is the head tool-crib keeper and the other his assistant. The assistant learns the job by working under the direction of the head tool-crib boy. At the end of the week, the assistant becomes the head tool-crib keeper and is given a "green" hand as assistant. He is then responsible for breaking in the "green" boy as tool-crib keeper, and of teaching him where the tools are stored and how they are issued and accounted for.

In many schools, it is the practice to hold the class in the room until the head tool-crib keeper has reported that all tools are in position, or are accounted for by checks of students. In this way, responsibility for return of tools is localized, and less trouble is likely to occur than if the class is dismissed before the report is rendered.

An interesting variation of this plan is employed by some instructors who appoint a permanent tool-crib inspector, whose duty it is to examine the tool crib of the department each day before the class is dismissed, reporting either that everything is in place or that tool number so-and-so has not been returned. In this way, the instructor is freed from routine responsibility, and some youngster is getting some excellent training.

Inventory

Most school systems require inventories of tools and material but once a year, and that at the close of the school year in June. Where schools are operated continuously, it is usually the custom to take inventory at some holiday, such as the Christmas vacation, or at some other time when the shop is not in operation. It is, however, possible to take a careful inventory at any time, even when the shop is running full blast.

Three methods of inventory-taking are commonly used: first, that of actually listing all tools in order as they are arranged in the crib, and comparing this list with the master list; second, that of keeping a perpetual inventory on a series of cards, and checking this perpetual inventory against the tools actually in the crib at any given time; and third, the practice followed in many large industrial establishments, of attaching a two-part tag to each tool or item.

The third method may be discussed first. On each tag is written a description of the tool, with any serial number or other identifying marks that will make the individuality of the tool evident. This is written on the check or tag and on a detachable stub which is numbered in duplicate with the tag that is attached to the tool proper. The inventory clerks go through the tool crib, tying a tag to each tool after the description has been written on the tag and stub. When inspection shows that every piece in the crib has been tagged, the clerks begin at one end to tear off the perforated stubs. It is evident that each piece in the crib is then represented by a tag bearing a serial number. These tags may then readily be checked against a master list.

The master list is made up of the list of tools known to be in the tool crib at the time of the last annual or periodical inventory. To this list is added a list of all tools purchased during the year. From it is deducted the list of all tools known to be destroyed or lost during the period since the last inventory. The resultant of these three factors represents the tools that should be present in the tool crib at the time of inventory. It is against this type of master list that the physical inventories are checked to determine losses during the period which the inventory covers.

Methods of Sharpening and Conditioning Tools

The methods of sharpening and conditioning tools are almost as many in number as the schools themselves. Some schools require the tool-crib boys to sharpen and condition tools during their free time in the tool crib. Where this is done under the instructor's guidance, it is an excellent plan of teaching proper care of tools, and is to be commended, since this constitutes an important part of the mechanic's skills and knowledge.

Some schools require the instructor to condition the tools during free periods or during vacations. The writer remembers vividly grinding and whetting over 400 firmer chisels two or three times each year while he was a college instructor in woodworking. When to this task was added the responsibility of grinding and whetting 192 wood-turning tools, the magnitude of the task can be appreciated.

Certain tools will need to be sent out of the school for conditioning. This is especially true of delicate precision tools, which should be returned to the manufacturer for overhauling. Most manufacturers do an excellent job of reconditioning tools, at a nominal price. Thus, calipers, verniers, and

micrometers should be returned to their makers if they are out of order in any respect. The instructor is rare who can repair these tools satisfactorily, especially if they are found to be in bad order. In the New Britain, Conn., State Trade School, each toolmaker apprentice takes turns in the tool-repair department, putting calipers, micrometers, etc., in order. This is usually assigned just before graduation.

Storage During Vacation

If a school is to be closed for the vacation, extreme care must be taken to put all tools in condition to withstand corrosion during the vacation. This is especially true of the long summer vacation, since dampness and heat combined may readily ruin delicate tools in a short time. Almost universally, cosmolene, a cheap commercial vaseline, is used as a "dope" for tools during storage. Fine tools are generously coated with cosmolene and then are wrapped in plain soft paper and laid away in trays or packed in boxes, secured against occasional marauders. Such protection will enable the tools to withstand adverse conditions during the summer. The writer remembers one shop, located in a basement, where the tools would have been entirely ruined had it not been for the careful work of the instructor before he went away for his vacation. A summer rain combined with a flooded sewer had flooded the shop with water several feet deep. The results of this had the tools been unprotected, can well be imagined.

During vacations, tools must also be protected against theft. This is easy if theftproof tool cribs are supplied with cylinder locks, shielded so as to be unpickable by means of string, wire, or hand worked through the wire mesh of the tool-crib inclosure. In general, storing tools in cosmolene and paper wrappings in *securely locked* cabinets or chests has been found to be sufficient protection.

Storage and Supplies

Nuts, bolts, screws, cotter keys, and other standard machine parts, as well as spare gears, spare cutters, and the like, are difficult to store unless care is taken. In general, since frequent calls are made for this material, they should be stored near the tool-crib window, for easy access. Perhaps the most satisfactory plan is that suggested by the Taylor System. Here, a plank frame is provided, furnishing pigeonholes, measuring 24½ by 24½ by 18 in. deep. In these large pigeonholes are fitted cabinets of drawers. Each cabinet measures 24 by 24 in. outside, by 18 in. deep. Excellent steel cabinets for this purpose may now be obtained. Some cabinets are furnished with as many as fourteen drawers in two ranges of seven each. Other cabinets are furnished with twelve, eight, six, or even four drawers. Small parts are readily stored in the smaller drawers of the cabinet, while larger parts may be stored in drawers of sufficient capacity. The system has the added advantage of being flexible, so that changing conditions will allow of a rearrangement of the various cabinets without the necessity for tearing the whole system to pieces.

The system in many automobile shops and machine-shop tool cribs in industry is significant. Here steel cabinets are used, with interchangeable partitions, so that a series of bins are provided in sizes graduated to the needs of the parts to be stored. Here again is the advantage of economy, because any changes in the requirements for storage mean merely a rearrangement of shelves and partitions in the steel cabinet. Furthermore, label holders are usually provided, in which the storekeeper can insert cards describing the contents of the several compartments in the cabinet. This method is recommended to schools desiring durable and economical parts storage.

Where cabinets are used, some way should be provided to care for parts of varying sizes and of varying requirements. This may be done by a graduated series of drawers or by other methods.

What has been said hitherto refers to the storage of loose parts in bins or drawers. Since machine screws and other standard parts are most economically purchased in packages of 50 to 100 or more, it is desirable to provide storage for unbroken packages to which the instructor only has access preferably by a special key. When the loose parts are reduced to a certain minimum, the tool-crib keeper then reports to the instructor, who personally supplies from the reserve store another package of the part in question. In this way, the opportunities for theft are reduced to a minimum.

Course II—Auto Mechanics

H. Allan Lacey

Industrial-Arts Instructor,
High School, Greenport, L. I., New York

A second-year senior-high-school automotive course which requires five periods a week for forty weeks for its completion.

THIS second-year course is planned to give the student a more specific knowledge of the modern automobile than was aimed at in Course I. The jobs selected bring in repairs that are more difficult and more complicated than those outlined for the work given in the previous course.

Job No. 1
TO REMOVE MOTOR FROM FRAME

Aim

To teach how to prepare and remove motor from frame.

Operations

Teach how to: remove radiator, carburetor, and other accessories from motor; disconnect drive shaft and remove transmission if necessary; take out motor-support bolts; prepare rope sling about motor and lift out motor with chain hoist.

Related Information

Science: Discuss operation of simple machines; lever, screw, wheel, etc. Teach theory and operation of various lifting machines; screw jack, hydraulic jack, chain hoist, etc. Mechanical advantage.

Tools and Materials: Pupils list all tools and materials used. Show other methods of doing same job.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: chain hoist; hydraulic; mechanical advantage; lever; wheel.

Safety: Teach how to suspend hoist from support which is strong enough to hold total weight of hoist and motor with wide margin of safety. Never overload hoist.

Computation: Pupils figure mechanical advantage of hoist, and find how much is lost in friction.

Drawing: Pupils make sketch showing principle of chain hoist.

Guidance: Discuss work of millwright.

References[1] and Illustrative Material

Automotive Service, p. 489; Dyke's *Automobile Encyclopedia*; *Automotive Essentials*, p. 35; *Automotive Trade Training*, p. 154.

Job No. 2
TO FIT AND INSTALL NEW PISTON RINGS

Aim

To teach how to remove old rings and fit and install new.

Operations

Teach how to: remove oil pan; remove head if necessary; dis-

[1]The textbooks referred to in this and the following lessons, are: *Automotive Service*, by Ray F. Kuns (The Bruce Publishing Co., Milwaukee, Wis.); Dyke's *Automobile Encyclopedia* (A. L. Dyke & Co., St. Louis, Mo.); *Automotive Essentials*, by Ray F. Kuns (The Bruce Publishing Co., Milwaukee, Wis.); and *Automotive Trade Training*, by Ray F. Kuns (The Bruce Publishing Co., Milwaukee, Wis.).

connect connecting rods; remove pistons; remove old rings; clean ring grooves; fit new rings and reassemble.

Related Information

Science: Discuss function of rings; different types of rings and advantages claimed for each type. Explain causes of oil pumping. Discuss expansion of metals and necessity of clearance at ring points.

Tools and Materials: Pupils list all tools and materials used. Teach special use of file in fitting rings. Show need of special compressors for some rings.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: piston; ring; oil ring; step out; bevel cut; tension; score; oil-pumping; piston slap.

Safety: Teach how to remove rings without cutting hands.

Computation: Pupils compute ring gap necessary to compensate for expansion of ring due to rise in temperature of 200 deg. C.

Drawing: Draw cross-section view of piston and rings as they would appear in cylinder.

Guidance: Discuss work of garage mechanic.

References and Illustrative Material

Automotive Service, p. 448; Dyke's *Automobile Encyclopedia,* p. 828; *Automotive Essentials,* p. 100; *Automotive Trade Training,* p. 169.

Job No. 3

TO INSTALL NEW WRIST PINS

Aim

To teach how to fit and install new wrist pins.

Operations

Teach how to: remove pins from piston by loosening set screws or by other method; adjust reamer to make light cut in piston; ream piston until new pin is tight push-fit; remove pin and scrape high spots in bearing; assemble; lock pin in place and replace in motor.

Related Information

Science: Discuss work of wrist pin. Motion of pin in piston. Teach necessity of close fit and good bearing surface. Discuss different methods of fastening pins in piston and advantages of each.

Tools and Materials: Pupils list all tools and materials used. Teach how to care for scraper and keep it sharp.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: reamer; oversize; scraping.

Safety: Teach how to handle reamer and piston in order to avoid injury to hands or work.

Computation: Pupils measure new pins with micrometers and find oversize.

Drawing: Pupils make cross-section sketch of piston, pin, and rod in proper position.

Guidance: Same as for Job No. 2.

References and Illustrative Material

Automotive Service, p. 459; Dyke's *Automobile Encyclopedia,* p. 797; *Automotive Essentials,* pp. 39 and 97; *Automotive Trade Training,* p. 153.

Job No. 4

TO TIME VALVES

Aim

To teach how to time engine valves.

Operations

Teach how to: drain and remove radiator; remove timing case cover; slack off chain adjustment or remove gears; place crankshaft and camshaft in proper relation to each other from position of No. 1 piston; replace chain or gear; fasten in place and test.

Related Information

Science: Review four-stroke-cycle principle. Discuss advantage of chain and gear timing. Show effect of improper timing. Show different types of cams and discuss advantages.

Tools and Materials: Pupils list all tools and materials used.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: four-stroke-cycle; sprocket; idler; tension; camshaft; cam.

Safety: Teach how to jack up motor when removing timing case cover in such a way that it will not fall. Teach care in handling gears and sprockets as they become sharp with wear.

Computation: Pupils figure speed of chain in feet per minute when car is traveling at twenty miles an hour.

Drawing: Pupils make diagram illustrating four-stroke principle.

Guidance: Discuss work of mechanical engineer.

References and Illustrative Material

Automotive Service, pp. 320 and 353; Dyke's *Automobile Encyclopedia,* pp. 59 and 1051; *Automotive Essentials,* p. 44; *Automotive Trade Training,* p. 142. Cut-away motor showing action of all parts. Working model of Knight-type motor.

Job No. 5

FITTING AND ADJUSTING MAIN BEARINGS

Aim

To teach how to fit and adjust main bearings.

Operations

Teach how to: jack up front end of car; remove oil pan and oil pipes; take down bearing caps; remove bearings from caps and block; put in new bearings; replace bearing and cap on blued shaft; turn motor; remove bearing and scrape high spots. When scraped to good surface, clean, oil, assemble with proper clearance, and lock in place.

Related Information

Science: Discuss lubrication systems and their relation to bearing clearance. Function of main bearings. Effect of loose mains on oil pressure.

Tools and Materials: Pupils list all tools and materials used. Explain construction of bearings and metals used.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: bearing; clearance; splash feed; full force feed; hollow crankshaft; drilled rods; babbitt metal.

Safety: Teach how to block up front end so as to avoid accidents.

Computation: Pupils find total main-bearing surface of motor.

Drawing: Pupils draw cross-section view of crankshaft showing shaft and all parts of bearing.

Guidance: Discuss work of machinist.

References and Illustrative Material

Automotive Service, pp. 523, 534, and 539; Dyke's *Automobile Encyclopedia,* pp. 41 and 781; *Automotive Essentials,* p. 60; *Automotive Trade Training,* p. 149. Cut-away motor showing crankshaft.

Job No. 6

TO REFACE SINGLE-PLATE DRY-DISK CLUTCH

Aim

To teach how to remove, reface and reassemble a single-plate dry-disk clutch.

Operations

Teach how to: disconnect drive shaft; remove transmission; remove clutch and brake pedals; clutch housing and bolts. Take out plate; remove old lining; reline with proper lining and reassemble. Adjust fingers and pedal clearance.

Related Information

Science: Teach theory of clutch action; friction. Discuss types of clutches — cone, single plate, etc. Advantages of each type.

Tools and Materials: Pupils list all tools and materials used. Discuss composition of lining. Stress use of proper rivets and lining to insure good job.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: friction; clutch; single plate; cone; multiple plate; fingers; throw-out bearing.

Safety: Teach proper way to release clutch springs to avoid injury to hands.

Computation: Pupils compute friction area of clutch.

Drawing: Pupils make drawing of simple cone clutch showing action.

Guidance: Same as Job No. 2.

References and Illustrative Material

Automotive Service, p. 276; Dyke's *Automobile Encyclopedia,* pp. 21 and 838, Chapter 14; *Automotive Essentials,* p. 299; *Automotive Trade Training,* Chapter 4. Several different type clutches taken from cars.

Job No. 7

TO INSTALL NEW UNIVERSALS

Aim

To teach how to install new universal joints in a car having open drive shaft.

Operations

Teach how to: disconnect rear end of drive shaft and remove front and rear universals; clean, inspect, and replace if necessary.

Related Information

Science: Teach necessity of universals as a means of transmitting power at an angle. Discuss other means of doing this, flexible shaft, etc. Discuss kinds of universals — open, closed, metal, fabric, etc. Advantages of each.

Tools and Materials: Pupils list all tools and materials used. Call attention to kind of grease used in universals.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: universal joint; open drive shaft; closed

drive shaft; fabric; universal; torque.

Safety: Teach care when working under car. Protect eyes from falling dirt when possible.

Computation: Pupils measure wear of parts with micrometers and compute lost motion.

Drawing: Pupils make sketch of universal joint.

Guidance: Same as for Job No. 5.

References and Illustrative Material

Automotive Service, pp. 220 and 295; Dyke's *Automobile Encyclopedia,* p. 860; *Automotive Essentials,* p. 305; *Automotive Trade Training,* p. 95.

Job No. 8
TO INSTALL NEW TRANSMISSION SHIFTING FORKS

Aim

To teach how to remove transmission cover and shifting forks, clean parts, install new forks and reassemble.

Operations

Teach how to: remove floor boards; remove transmission cover; remove shafts and forks; clean parts; install new forks and reassemble.

Related Information

Science: Discuss necessity of transmission and its function. Teach how reduction of speed and increase in power is obtained through use of different-sized gears. Reverse motion. Discuss improved types of transmission. Other methods of speed change.

Tools and Materials: Pupils write up list of all tools and materials used.

Terminology: Pupils learn and write up meaning of terms and function of parts listed; sliding gear; progressive; selective, countershaft; main shaft; clutch shaft; shifting forks; gear ratio.

Safety: Teach never to run motor with transmission cover off.

Computation: Pupils find gear ratio of low, second, and reverse speeds from number of teeth on gears.

Drawing: Pupils show by drawing how reverse motion at 2 to 1 ratio is obtained by use of gears.

References and Illustrative Material

Automotive Service, p. 260; Dyke's *Automobile Encyclopedia,* p. 1060; *Automotive Essentials,* p. 265; *Automotive Trade Training,* p. 83. Cut-away transmission showing all parts.

Job No. 9
TO INSTALL NEW RING AND PINION GEARS

Aim

To teach how to install new ring and pinion gears. Reassemble and adjust.

Operations

Teach how to: jack up; remove wheels and axles; drain rear end; remove cover; disconnect drive shaft, remove pinion shaft, remove differential assembly, clean parts, remove ring gear and pinion from assemblies, and replace with new. Reassemble and adjust.

Related Information

Science: Discuss transmission of power at right angles; reduction of speed through bevel gears; different types of bevel gears. Teach theory and operation of differential. Types of rear ends and advantages of each type.

Tools and Material: Pupils list all tools and material used.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: differential; pinion; ring gear; thrust bearing; spider gears; semifloating; three-quarter floating; full floating.

Safety: Teach how to avoid cutting hands on sharp gears.

Computation: Pupils find gear ratio of rear end from number of teeth on pinion and ring gears.

Drawing: Pupils make sketches showing four kinds of rear ends.

Guidance: Discuss work of machinist.

References and Illustrative Material

Automotive Service, p. 155; Dyke's *Automobile Encyclopedia; Automotive Trade Training,* p. 67.

Job No. 10
TO INSTALL NEW BRUSHES IN GENERATOR AND STARTER

Aim

To teach how to remove starter and generator; remove old brushes and replace with new.

Operations

Teach how to: remove starter and generator if necessary; remove brush cover; unscrew brush leads; take out old brushes; clean commutator; put in new brushes and reassemble. Test brush springs for proper tension.

Related Information

Science: Review and discuss theory of electric motor and generator. Different types of winding for generator and motor. Function of brushes.

Tools and Materials: Pupils list all tools and materials used on this job.

Terminology: Pupils learn and write up the meaning of terms and function of parts listed: generator; starter; field, armature; shunt; series; ampere; volt.

Safety: Teach how to handle electrical equipment so as to avoid breaking and injury to workman.

Computation: Pupils compute horse power of a starter using 100 amperes at 6 volts.

Drawing: Pupils show by diagrams the difference between series- and shunt-wound electrical machines.

Guidance: Discuss work of automotive electrical worker.

References and Illustrative Material

Automotive Service, p. 974; Dyke's *Automobile Encyclopedia; Automotive Essentials,* p. 210; *Automotive Trade Training,* p. 487; Delco-Remy Manual. Starting motors and generators from different makes of cars.

Job No. 11
TO REBUSH FRONT END

Aim

To teach how to install new bushings and bolts in front end.

Operations

Teach how to: remove front wheels; remove steering knuckles; clean; remove old bushings; press in new bushings; ream to fit new bolts and reassemble. Test for alignment, caster, and camber.

Related Information

Science: Discuss types of steering gears and front axles and advantages of each type. Causes of hard steering, shimmy, etc.

Tools and Materials: Pupils list all tools and materials used. Teach care of reamers.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: steering knuckle; spindle; bushing; king bolt; tie rod; drag link; shimmy; alignment.

Safety: Teach how to block up front end so as to avoid danger of falling.

Computation: Pupils measure king bolt and reamer with micrometer and find clearance allowed.

Drawing: Pupils make cross-section drawing of steering knuckle showing king bolt and bushing.

Guidance: Discuss work of brass-foundry workers.

References and Illustrative Material

Automotive Service, p. 99; Dyke's *Automobile Encyclopedia,* p. 900; *Automotive Essentials,* p. 353; *Automotive Trade Training,* p. 25. Mounted steering gear and axle.

Job No. 12
TO REWIRE LIGHTING AND IGNITION SYSTEMS

Aim

To teach how to rewire lighting and ignition systems from diagram.

Operations

Teach how to: remove all old wiring and rewire from diagram, using proper wire for each circuit. Solder terminals where necessary.

Related Information

Science: Discuss electrical conductors and insulators. Size of wire dependent on current carried. Necessity for heavy insulation on high-tension wires. Fuses. Ohm's law.

Tools and Materials: Pupils list all tools and materials used.

Terminology: Pupils learn and write up meaning of terms and function of parts listed: conductor; insulator; high tension; low tension; ground return; fuse switch.

Safety: Teach how to fasten wires to avoid chafing and possibility of fire.

Computation: Pupils find resistance of a light bulb which draws four amperes at six volts. Use Ohm's law.

Drawing: Pupils show by diagram how to wire a spotlight so that current used will be shown by ammeter. Circuit to include fuse.

Guidance: Same as for Job No. 10.

References and Illustrative Material

Automotive Service, p. 986; Dyke's *Automobile Encyclopedia; Automotive Essentials,* p. 234; *Automotive Trade Training,* p. 325; Delco-Remy Manual.

Simplified Trouble Shooting

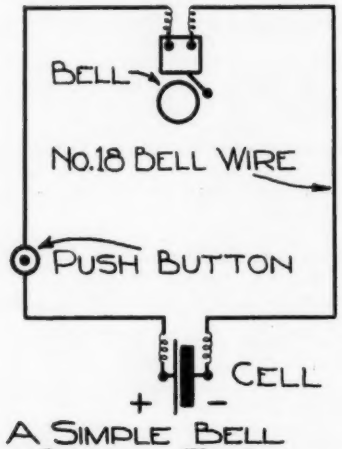
Edward B. Flaherty

Warren-Bunker Hill District,
Boston, Massachusetts

Habituating the student to follow a routine method when searching for a defect in a circuit makes electrical trouble shooting a systematic process and not an aimless excursion into the realms of mystery.

WHEN pupils are being taught how to put up a simple bell circuit, the material supplied them may at times be defective because frequently it has been used by other classes. In most instances the pupil does not know how to test this material before he installs it, and he proceeds as though everything were perfect. If the bell operates, all is well; but if it does not, he is at a loss to find the reason for its not working.

It is well therefore to instruct the pupils in the principles of "trouble shooting" so that he may know how to locate defective material or bad workmanship on jobs performed by himself or others.



A SIMPLE BELL CIRCUIT FIG. 1

To do this, draw a diagram of Figure 1 on the blackboard. Ask one of the students to trace and name the material of the circuit. Write down his responses: bell, bell wire, push button, and battery, as he gives them. Then ask these questions:

1. What is used as a source of electricity in this case? (Where does the electricity come from?)
2. What conducts the electricity along the circuit?
3. What controls the circuit?
4. What uses the electricity?

These four questions give the four important factors, namely:

1. Source of electricity
2. Conductors
3. Controlling device
4. Usage of electricity

These should be impressed on the student.

Next write the materials and the factors in two columns,

Factors	*Material*
Source of electricity	Cell or battery
Conductors	Bell wire
Controlling device	Push button
Usage of electricity	Vibrating bell

Then demonstrate the shooting of trouble on a defective job by the method of elimination.

1. Ask a pupil to test the cell, using a good bell, connected to the binding posts by wires, or a voltmeter may be used.

This test may or may not locate the trouble. At any rate, the *source of electricity* is checked.

2. Another pupil should then test each piece of wire used on the job, for breaks, insulation, wire loops, and clean ends. Use a bell test set, the free ends touching each end of the wire to be tested.

This test of the *conductors* may or may not locate the trouble.

3. Next ask a pupil to remove the cover of the push button, and to examine the spring, contacts, insulation and loops.

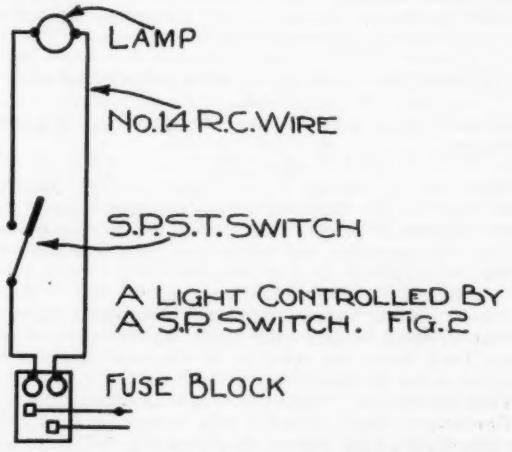
This completes the test of the *controlling device,* and may or may not locate the trouble.

4. Ask another pupil to test the bell. Have this done with a cell which has two wires connected to its binding posts.

Again, this test may or may not locate the trouble, but the *usage of electricity* has been tested.

The problem is to find which one of these four factors discloses the defect which prevents the bell from operating properly.

When the pupils are about to start working on lighting circuits, review the use of these factors in discovering defects.



A LIGHT CONTROLLED BY A S.P. SWITCH. FIG.2

In Figure 2 the cell has been replaced by a fuse block, the bell wire by No. 14 R.C. wire, the push button by a S.P.S.T. (single-pole, single-throw) knife-type switch, and an electric lamp is used instead of the bell.

The materials and factors for this test may be listed as follows:

Factors	*Material*
Source of electricity	Fuse Block
Conductors	No. 14 R.C. wire
Controlling device	S.P.S.T. knife switch
Usage of electricity	Lamp

In testing a defective circuit, use the process of elimination in the same manner as was done with the bell circuit. If 110-volt current is used, test the lamp with another 110-volt source. The source of supply may be checked by testing the fuses.

Other Suggestive Problems

Problem I

Suppose you have a defective soldering iron.

Factors	*Material*
Source of electricity	Plug outlet
Conductors	Cord
Controlling devices	Attachment plug
Usage of electricity	Soldering iron

Problem II

Suppose you have a vacuum cleaner that does not work.

Material	*Factors*
Plug outlet	Source of electricity
Cord	Conductors
Attachment plug and switch in handle	Controlling devices
Motor	Usage of electricity

After the pupil has become accustomed to talk in terms of these factors, he is in a position to introduce theory into his search for electrical troubles. This ability to do trouble shooting in an orderly manner will be helpful to the student, especially when he gets into advanced electrical work.

Printshop Instruction Sheets

E. H. Rueter

West High School,
Cleveland, Ohio

Using operation sheets, information sheets, and job sheets to lighten and make more efficient the work of instruction in the printshop.

IN ORDER that large classes of boys with varying degrees of intelligence, experience, and ability could be properly taken care of in the printshop, led to the abandonment of the formal class method and to the development of instructional material more especially suited to the individual instruction method.

These *instruction sheets* were divided into three types: the *operation sheet*, the *information sheet*, and the *job sheet*.

The *operation sheet* was designed to give in detail those steps in the fundamental operations which often recur in any series of class projects or even in the same project. Operation sheets, therefore, are standardized, and are provided so that the learner may refer to them as occasion arises. The *job sheet* gives a short outline of the steps necessary to complete a specific job or project. It refers at certain steps to the operation sheets which tell in detail how these steps are to be performed. The *information sheet* must be carefully organized and presented in simple and direct words and statements. Appropriate illustrations will aid the student in grasping this information. Information sheets may be devised so that they correlate with the job sheets or they may be used independently.

The combination of these various sheets gives each student the opportunity to work by himself, and, with a little help, to advance as rapidly as his ability permits.

Operation Sheets

After a careful analysis of the operations to be performed in the composition of numerous pieces of printed matter, it was found that a knowledge of the following 21 basic operations would be necessary to perform ordinary composition work.

1. Assembling type into a composing stick.
2. Proofing type in a stick.
3. Distributing type from a composing stick.
4. Justifying flush left or right.
5. Centering a line of type.
6. Justifying a line between words.
7. Justifying flush left and right.
8. Removing type from stick.
9. Tying up a type form.
10. Proofing a type form on a galley.
11. Reading and marking proofs.
12. Making corrections on a galley.
13. Making up a type form.
14. Locking up a simple form.
15. Unlocking a simple form.
16. Distributing type from the galley.
17. Pulling a stone proof.
18. Making up a rule border.
19. Breaking up a form for color.
20. Piecing leads and slugs.
21. Use of initial letters.

These operations are grouped particularly according to their frequency of use and with some consideration as to their difficulty of performance.

Detailed instruction as to how each operation is performed, presenting a sequence of steps together with appropriate illustrations, were combined into printed operation sheets. Care had to be taken not to make the terminology too technical, and to use language that the pupils readily understood.

Operation sheet No. 6 shows a typical example.

Information Sheet

The information needed to complete these various printed jobs was listed separately. This material together with such additional information as the history of printing, manufacture of type, etc., was organized and presented on the *information sheets*. The need for simple words and concrete illustrations had been brought out by observing the difficulty which a majority of students have in grasping the information presented in most textbooks.

These information sheets were based on the following:

1. History of Printing
   - *a*) Invention
   - *b*) Evolution
   - *c*) Present-day opportunities, wages, etc.
2. California Job Case
   - *a*) Why arranged
   - *b*) How arranged
3. Type, Its Manufacture and Parts
   - *a*) How made
   - *b*) Names of parts
   - *c*) Its uses
   - *d*) Care in using
4. Quads and Spaces
   - *a*) Their uses
   - *b*) Comparative sizes
5. The Composing Stick
   - *a*) Its use
   - *b*) Names of parts; why used
   - *c*) How to adjust
   - *d*) Care in handling
6. The Line Gauge
   - *a*) The pica-nonpareil
   - *b*) How and when to use
7. The Point System
   - *a*) Point, pica, nonpareil
   - *b*) Type sizes, etc.
8. How to Read Type in the Composing Stick
9. How to Distinguish b, d, p, q
10. Leads and Slugs
    - *a*) Their uses
    - *b*) Their sizes
    - *c*) Care in handling
11. Brass Rule, Borders, Ornaments, Initial Letters
    - *a*) Their uses
    - *b*) Hints about using appropriately, harmoniously
    - *c*) Care in handling
12. Metal Furniture
    - *a*) Its uses
    - *b*) Sizes
    - *c*) Care in handling
13. Wood Furniture
    - *a*) Its uses
    - *b*) Sizes
    - *c*) Care in handling
14. Type Faces
    - *a*) Text, roman, italic, etc.
    - *b*) Use of appropriate faces
    - *c*) How to distinguish
15. Proofreading
    - *a*) Why read proof
    - *b*) Why use marks
    - *c*) History of
16. Proofreaders' Marks
    - *a*) List of

PRINTING OPERATION SHEET NO. 6

Justifying Between Words

The Job to be Done:

To place the proper spaces between words.

Purpose:

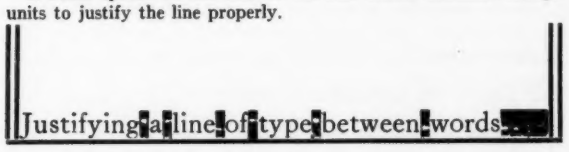
Lines must be spaced to the same length and have as nearly the same number of units as possible between words in order to make a paragraph.

Tools and Material:

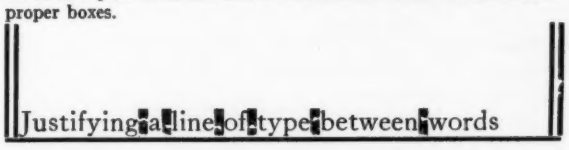
Composing stick; case of type.

How to Do the Job:

1. Place spaces at the end of the line which contains enough units to justify the line properly.



2. Remember the number of units at the end of the line. Remove the space from the end of the line and return them to their proper boxes.



3. Count the number of 3-to-the-em spaces you have between the words and divide the number of units you had at the end of the line by the number of 3-to-the-em spaces.

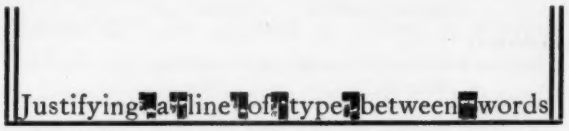
4. Add this number to 20, which is the number of units in the 3-to-the-em space. This gives you the number of units to place between each word when the line is justified.

5. If the number of units you need is not listed in the Unit Table, find the two numbers that it would be between. Then some of the spaces must contain the larger and some the smaller number of units. For example: If you need 31½ units, some of your spaces must be 30 and some 32; or, if you need 22½, you must use some 20 and some 24.

6. Remove the letter from the end of line.

7. Take out the 3-to-the-em spaces one at a time and put in spaces containing the number of units necessary to justify the lines.

8. Return the letter to the end of the line.



9. Test the line by the following method: Place the stick down with the open side away from you. Press on both ends of the line with the thumbs of both hands. Tip the line slightly toward the open end of the stick. If the line will stay in this slanting position by itself without falling, it is tight enough. If you cannot tip it forward easily, it is too tight.

Kind of Space	*No. Units*
Solid	00
5 to the em	12
4 to the em	15
3 to the em	20
Two 5 to the em	24
4 to the em and 5 to the em	27
2 to the em	30
3 to the em and 5 to the em	32
3 to the em and 4 to the em	35
Three 5 to the em	36
4 to the em and two 5 to the em	39
Two 3 to the em	40
5 to the em and 2 to the em	42
3 to the em and two 5 to the em	44
4 to the em and 2 to the em	45
3 to the em, 4 to the em and 5 to the em	47
Four 5 to the em	48
3 to the em and 2 to the em	50
4 to the em and three 5 to the em	51
5 to the em and two 3 to the em	52
2 to the em and two 5 to the em	54
4 to the em and two 3 to the em	55
3 to the em and three 5 to the em	56
5 to the em, 4 to the em and 2 to the em	57
3 to the em, 4 to the em and two 5 to the em	59
1-em quad	60
2-em quad	120
3-em quad	180

---

b) Their meanings
17. Punctuation — Typographical Use of
  a) Period
  b) Comma
  c) Interrogation
  d) Exclamation
  e) Quotations, etc.
18. Dividing Words
  a) When to divide
  b) How to divide
  c) How to use dictionary
19. Tweezers
  a) How to use
  b) Precautions against using
  c) Results of tweezers slipping over type face
20. Paper
  a) Kinds
  b) How purchased; ream; size of sheets
  c) Manufacture
21. Dictionary of Printing Terms
22. Principles of Display
  a) What to display
  b) How to display
  c) Various styles
  d) Spacing for ease in reading
  e) Hints about
23. Principles of Design
  a) Proportion
  b) Shape harmony
  c) Tone harmony and contrast
24. Use of Color in Printing
  a) How done
  b) Color harmony
  c) Hints in use of

Information sheet No. 1 shows a typical example.

Job Sheets

The job sheets were so designed that to complete each job the student had to master certain operations and have certain information at his command. Care was taken to so arrange the sequence of the job sheets that each new job brought in only one or two new operations or one or two new points of information.

If too much time was taken from the job itself in the study of new operations or new information, the boy lost interest. The immediate need for the one or two items of information necessary furnished the incentive for studying either the information or the operation sheets.

In order to furnish the drill necessary for complete learning, various combinations of operations and information were devised to lend variety to the work. Tests after certain combinations of jobs or units of work act as a check upon the student's ability. Unless the student successfully completes the test, he is not permitted to go on.

An almost endless number and variety of job sheets can be arranged to correlate with the information and operation sheets. The sequence and number of jobs covering certain operation sheets depends on the type of student and number of semesters he is to take printing. That is, if a student is to specialize in or take several semesters of printing, his schedule of jobs is so designed that he is given more intensive drill in the various operations. When a student is to take only one or two semesters of printing, the jobs are arranged so that the amount of drill is held to a minimum.

See job sheet No. 8.

A partial list of job sheets designed for 8B students, together with the operation and information sheets they correlate with, follows:

Job No. 1. Drawing the California job case requires information sheet No. 2 on the California job case.

Job No. 2. Placing letters in the case.

Job No. 3. Learning the case.

Job No. 4. Test on knowledge of the case and information about the case.

Job No. 5. Study Information Sheets Nos. 1, 3, and 5 on history of printing; type, its manufacture and parts; the composing stick.

Job No. 6. Setting and distributing letters and words requires knowledge of Operation Sheet No. 1, assembling type in a composing stick; Operation Sheet No. 3, how to distribute type, and Information Sheet No. 8, how type is read.

Job No. 7. Setting lines and justifying flush. This is the repetition of Operation Sheets Nos. 1 and 3 and brings in No. 4, justifying flush left.

Job No. 8. Setting and justifying lines and pulling proof. This is a repetition of Operation Sheets Nos. 1, 3, and 4, and Information Sheets Nos. 3, 4, 5, and 8 and brings in for the first time Operation Sheet No. 2, how to pull proof in a stick.

Job No. 9. Centering lines. This is a repetition of Operation Sheets Nos. 1, 2, and 3 and Information Sheets Nos. 3, 4, 5, and 8 and brings in for the first time Operation Sheet No. 6, centering a line of type, and Information Sheet No. 9, how to distinguish d, p, b, q.

Job No. 10. Setting a paragraph is a repetition of Operation Sheets Nos. 1, 2, 3, 4, and 6 and Information Sheets Nos. 3, 4, 5, 8, and 9 and brings in for the first time Operation Sheet No. 7, justifying between words, and Information Sheet No. 10, on leads and slugs.

In this way, by following a carefully planned series of operation, job, and information sheets, the boy is enabled eventually to set the type, make up the job, put on a border, read and mark the proof, correct the type, and finally lock it for the press.

A number of questions are included on some of the job sheets for the purpose of emphasizing certain points of information. These questions must be answered and turned in with the proof of the completed job.

This type of instruction permits the naturally ambitious and intelligent boy to progress as rapidly as he desires, and allows the slow or backward student to get the benefit of more attention from the instructor while he is motivated in his work by the example set by the more brilliant student.

PRINTING INFORMATION SHEET NO. 1

Quads and Spaces

Quads and spaces are pieces of type which are not as high as the pieces which print letters. Therefore, they print nothing at all; they are just what their name says they are — space, blank space. The four widest of these pieces of type are called quads; ½-em quad, commonly known as the en quad, the em quad, the 2-em quad, and the 3-em quad. The thinner ones are called spaces. There are three of these: 3-to-the-em space, 4-to-the-em space, and 5-to-the-em space. These quads and spaces are used to separate words and blank out the end of short lines of type as is shown below.

A Good Motto

Do what you are paid to do, and then some. It's the then some that gets your salary increased.

Spaces and quads are used to center the line.
A 1-em quad is used for indention of paragraph.
3 to the em, 4 to the em, 5 to the em spaces between words.
Spaces and quads to blank out the line.

Each of the spaces is a fraction of a 1-em quad wide. The 2-em quad is twice as wide as the 1-em quad and the 3-em quad is three times as wide as the 1-em quad.

The 1-em quad ■ is the square quad and is the one with which we measure all the rest of the quads and spaces. Two of the 1-em quads placed side by side are the same as one 2-em quad ■. Three 1-em quads are the same as one 3-em quad ■.

The en quad ▌ is one half as wide as the 1-em quad. Therefore, two of them, placed side by side, will form a square the same size as the 1-em quad. The 3-to-the-em space ▐ is the next smallest or one third as wide as the 1-em quad. It is just what its name says it is, three of them to make a 1-em quad. The next smallest is the 4-to-the-em space | which is one fourth of a 1-em quad. It takes four of these, placed side by side, to form a 1-em quad. The thinnest space of them all is the 5-to-the-em space | which is one fifth as wide as the 1-em quad.

When setting type, there is only one way to tell the size of the space you are using. If you think the space you are using is a 4-to-the-em space, pick up three more spaces which are exactly the same width as the one you have. Place the four spaces side by side and if they form a square which is the same size as a 1-em quad they are correct. If four do not form a square they are not 4-to-the-em spaces.

JOB NO. 8
Practice in Typesetting

The Job to be Done:

Set in type the practice exercise below.

Purpose:

To become acquainted with the letters as they appear in type, and to gain practice in setting type.

Material and Tools:

Composing stick; case of 10-point type.

How to Do the Job:

1. See that your stick is set to 15 picas.
2. Set a line of the following words and place a 3-to-the-em space between each word.

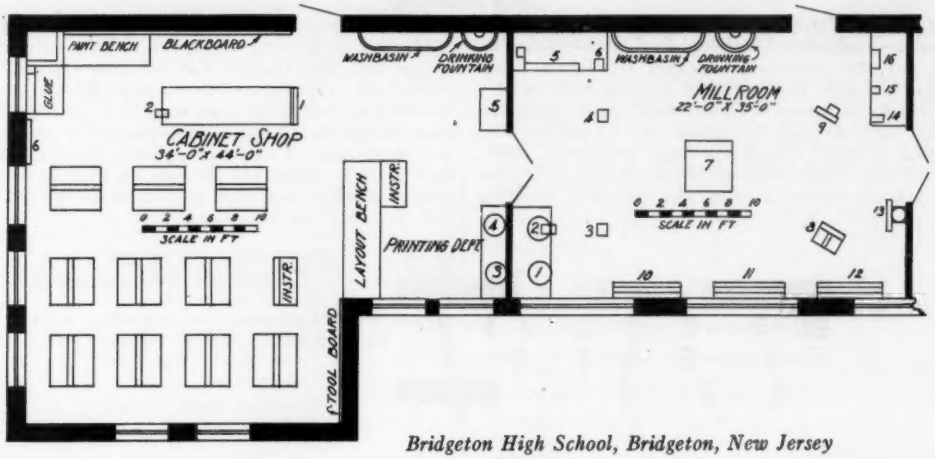
bend bad birds dumb drab dribbles bread bud dark educate his him hit dump ditch get hip always wave effort affluence type office done jet knife and an stick wet use

3. Check each line with instructor.
4. When all lines are checked, pull a proof by following the directions in Operation Sheet No. 2.
5. Be sure type is cleaned after pulling a proof.
6. Distribute type back into their proper boxes.
7. Paste your proof on a sheet of notebook paper and keep it in your notebook.

School Farm Shop, Worland, Wyoming

Shop Layouts

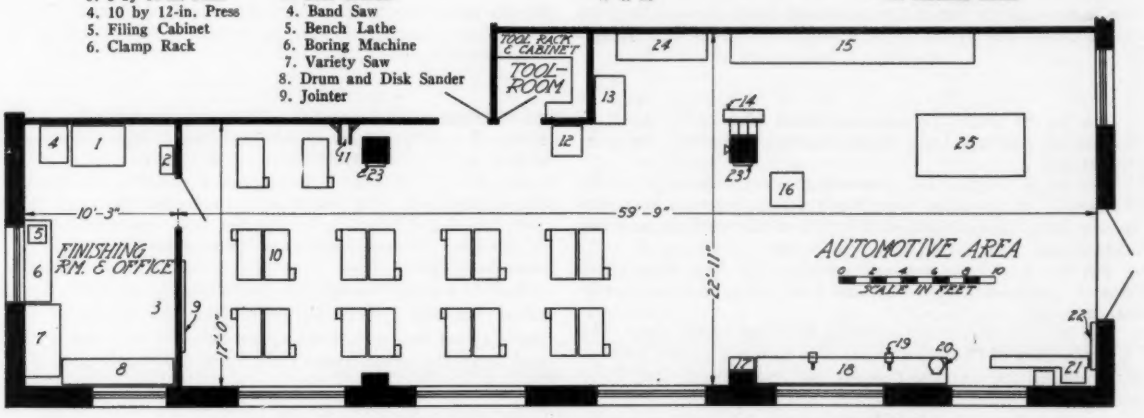
For additional shop layouts see pages 36, 37, 38, 39. 42, and 44



Bridgeton High School, Bridgeton, New Jersey

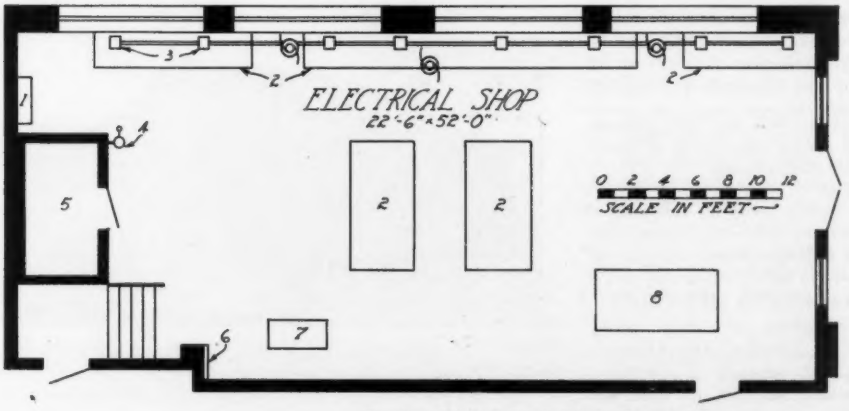
Cabinet Shop
1. Miter Box
2. 4-in. Machine Vise
3. 8 by 10-in. Press
4. 10 by 12-in. Press
5. Filing Cabinet
6. Clamp Rack

Millroom
1. Spindle Sander
2. Jig Saw
3. Tool Grinder
4. Band Saw
5. Bench Lathe
6. Boring Machine
7. Variety Saw
8. Drum and Disk Sander
9. Jointer
10. Speed Lathe
11. Speed Lathe
12. Speed Lathe, Combination W & M
13. Mortising Machine
14. Portable Drill
15. Molding Machine
16. Machine Lathe



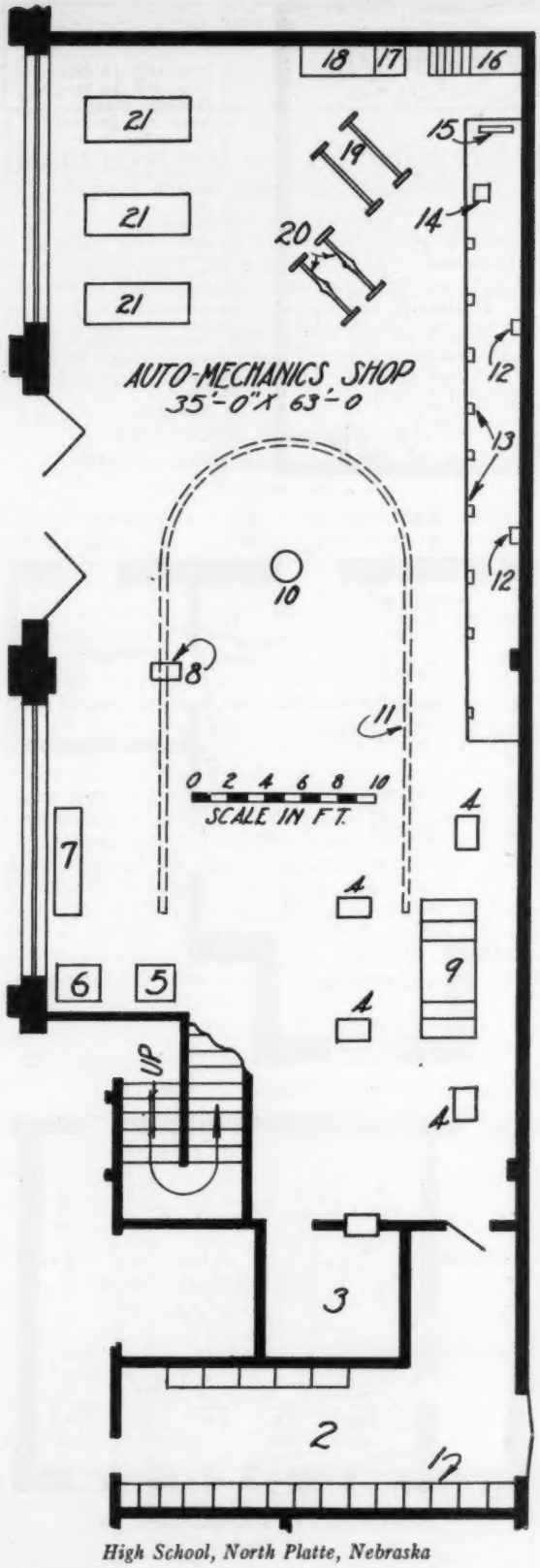
Industrial-Arts Laboratory, North Olmsted High School, North Olmsted, Ohio

1. Desk
2. Book and Magazine Rack
3. Balcony for Projects
4. Filing Cabinet
5. Paper cutter
6. Supply Cabinet
7. Storage Space
8. Finishing Bench
9. Blackboard
10. Woodworking Bench
11. Brush Rack
12. Miter Box on Pedestal
13. Glue Table and Clamp Rack
14. Jointer (Portable)
15. Lumber Rack
16. Universal (Portable)
17. Grinder on Pedestal
18. Metal-Working Bench
19. Machinist Vise
20. Bench Drill
21. Wood and Metal Lathe
22. Lathe Tools and Attachments
23. Bulletin Board
24. Sink
25. General Workbench



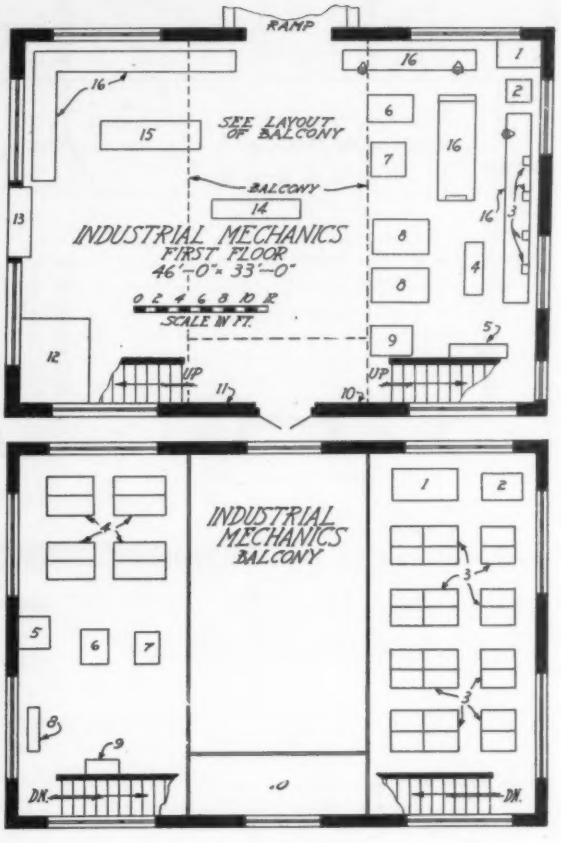
1. Sink
2. Workbench
3. Ovens
4. Drill Press
5. Toolroom
6. Power Box
7. Teacher's Desk
8. Library Table

Dunbar High School, Little Rock, Arkansas



High School, North Platte, Nebraska

1. Lockers
2. Washroom
3. Toolroom
4. Anvils
5. Emery Wheel Machine
6. Drill Press
7. Lathe
8. Chain Hoist
9. Forge
10. Drain
11. Track
12. Gas Furnace
13. Vise
14. Grinder
15. Speed Lathe
16. Battery Charger
17. Sink
18. Bench
19. Front Axles
20. Rear Axles
21. Live Motors



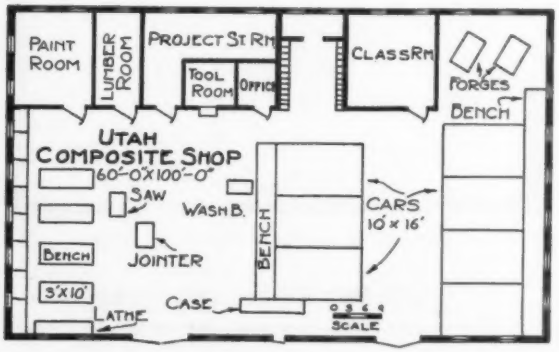
Zimmerman Junior High School, Flint, Michigan

First Floor:

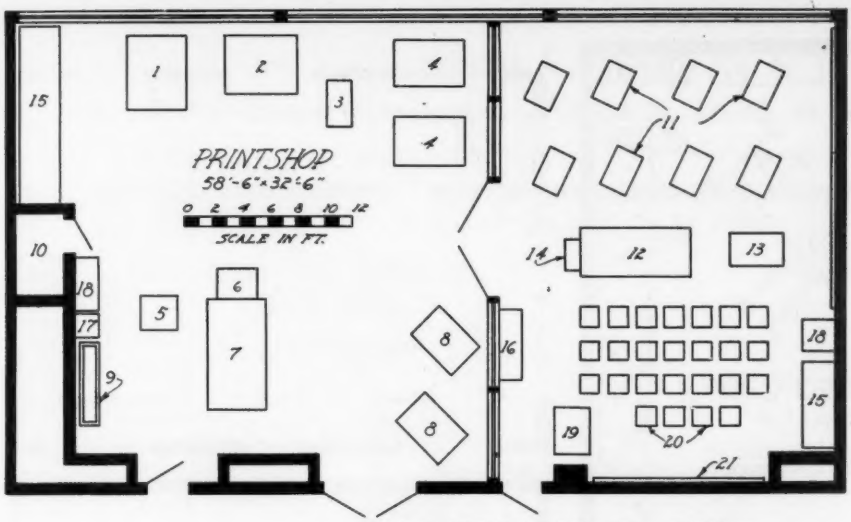
1. Forge
2. Anvil
3. 4 Gas Furnaces
4. Metal Lathe
5. Rack
6. Drill Press
7. Squaring Shears
8. Motor
9. Arbor Press
10. Blackboard
11. Bulletin Board
12. Toolroom
13. Storage Case
14. Auto Hoist
15. Electrical Bench
16. Benches

Balcony:

1. Instructor's Table
2. Teacher's Desk
3. 24 Drawing Benches
4. 8 Woodworking Benches
5. Tool Grinder
6. Band Saw
7. Variety Saw
8. Wood Lathe
9. Jointer
10. Runway

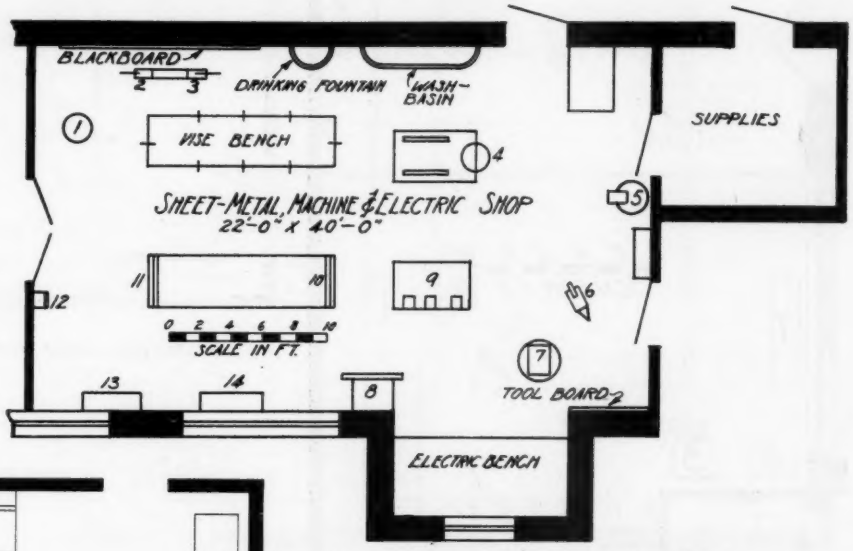


Utah Composite Shop, Salt Lake City, Utah



1. 12 by 18-ft. Job Press
2. 14 by 20-ft. Job Press
3. Composing Stone
4. 10 by 15-ft. Job Press
5. Cutting Press
6. Form Rack
7. Drying Rack
8. Linotype
9. Sink
10. Storage Closet
11. Type Cabinet
12. Composing Stone
13. Auxiliary Cabinet
14. Proof Press
15. Storage Cabinet
16. Steel Galley Racks
17. Wardrobe Cabinet
18. Filing Cabinet
19. Desk
20. Chairs
21. Blackboards

Fordson High School, Dearborn, Michigan

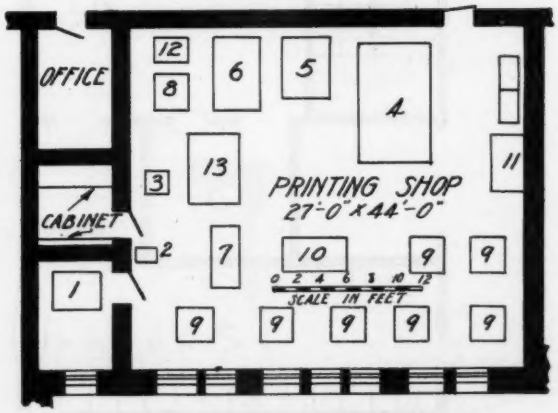


1. Wire, Bead and Setting Down Machine
2. Hand Cutter
3. Punch
4. Bending Machine
5. Drill Press
6. Anvil
7. Gas Furnace
8. Milling Machine
9. Soldering Bench
10. Forming Machine
11. Brake and Former
12. Emery Grinder
13. Back-Geared Gap Lathe
14. Back-Geared Lathe

Bridgeton High School, Bridgeton, New Jersey

Floor plan of a farm school shop, Kansas

1. Nails and Bolts
2. Woodworking Bench
3. Tools
4. Farm Light Plant
5. Forge
6. Coal
7. Stove
8. Grinder
9. Drill
10. Gas Engine or Motor
11. Vise
12. Iron Working Bench
13. Lathe



Washington Park High School, Racine, Wis.

1. Linotype Machine
2. Saw Cutter
3. Brass Rule Cabinet
4. Cylinder Press
5. Platen Press
6. Paper Cutter
7. Proof Press
8. Punch
9. Type Cases
10. Imposing Stone
11. Drying Rack
12. Stitcher
13. Bindery Table

Problems and Projects

CARRYING CASE FOR DRAWING TOOLS

Glenn H. Osborne, High School, Ottumwa, Iowa

(See Supplement No. 260)

In high schools where no provision is made for the care of student equipment in the drawing room, it is necessary that the drawing tools are carried back and forth from the boy's locker. This box was designed to make this job easier.

Any kind of material may be used for this project. As a matter of fact, some very good carrying cases were made out of packing boxes that were brought in by the boys.

LEATHER CRAFTWORK

Ross C. Cramlet, Junior-Senior High School, Newton, Iowa

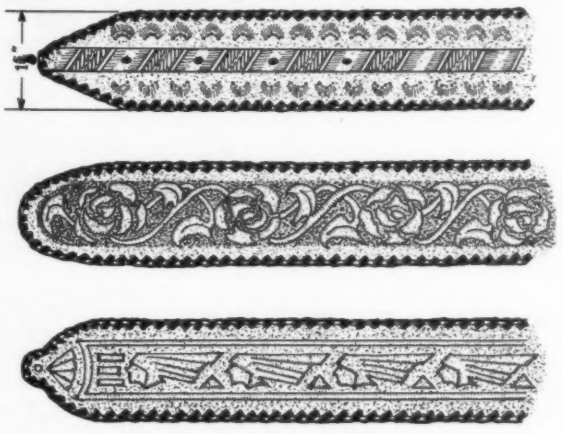
After beginners in leather work have completed several simple articles, it is usually advisable to encourage larger and more complicated projects. Book ends and belts have proved to be very practical and useful.

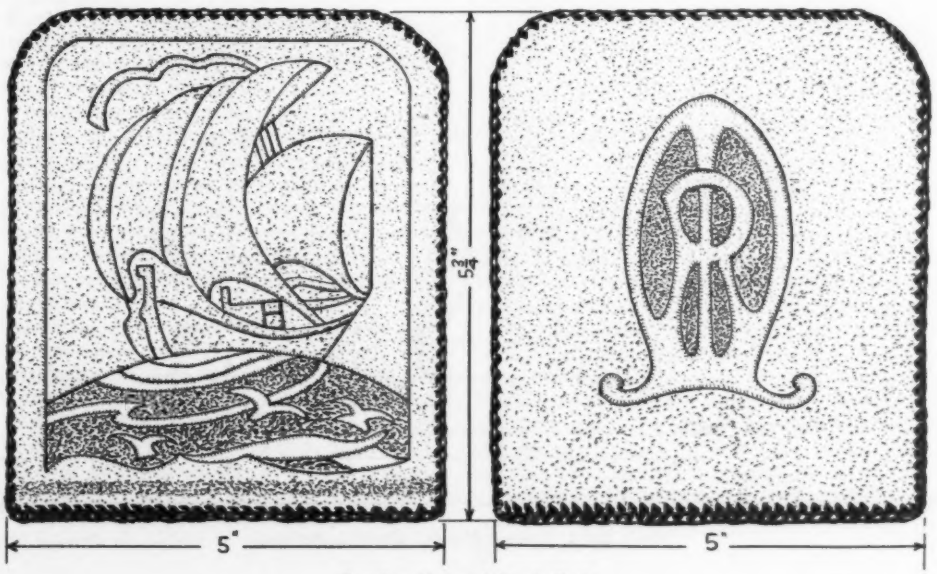
The book ends, as shown in the cut, are built over ordinary steel bookholders which can be purchased in any book or office supply store for not to exceed 35 cents a pair. The first step in making this project is to cover the upright portion of the frame on each side with thin cardboard. Then cut the leather so it will fit this frame with a ⅛-in. margin all the way around the leather. The most satisfactory way to do this is to cut the leather considerably larger than the frame. Place it over the frame and glue it with leather cement. Then trim it off with a sharp knife allowing ⅛-in. margin for the stitch. The cost of the leather may be reduced by using suede on the bottom. After the leather has been cut and fitted to the frame, it may be removed for tooling. The desired pattern should be made on a piece of paper the exact size of the leather and traced off in outline form. Answers to any questions which may arise relative to tooling may be found in *Handbook of Craftwork in Leather*.[1] After the tooling is completed, the leather is placed back on the frame as it was originally cut. If it has stretched from being dampened, it should be trimmed off to the ⅛-in. margin. The next step is to space the holes with a tracing wheel and lace with a ⅛-in. goatskin thong. See job sheet 8.[2]

Leather belts also are very popular with boys. There are two types which can be made. One involves a tool design, and the other a stamped design. The stamped design seems to be the favorite. Before making any attempt to place a design on the leather, try it out on a piece of scrap material. Be sure to strike lines on the leather with a straightedge so the stamps can be kept straight. Take plenty of time while using the stamps to make sure that they are turned right before the blow is struck. Straight lines and an even impression are the secret in effective work with stamps.

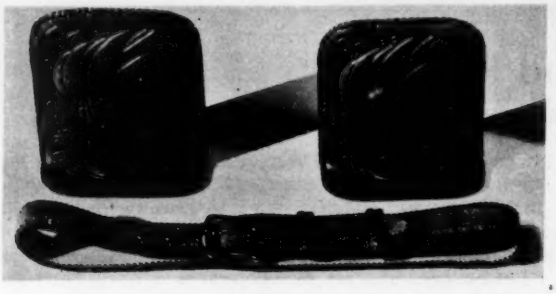
For the tooled designs on belt work, follow the procedure

[1]Published by Lester Griswold, 623 Park Terrace, Colorado Springs, Colorado.
[2]Published by Wilder and Co., 1038 Crosby St., Chicago, Ill.





Leather-Covered Book Ends



as described for the book ends. The lacing also is to be done in the same way.

A PROJECT IN ORNAMENTAL WOOD TURNING FOR THE SCHOOL SHOP

Lemuel Harris, Nogales, Arizona

The accompanying illustrations show a fruit bowl which may be made of any available wood, but better results will be obtained if close-grained wood such as maple, gumwood, black walnut, or myrtle wood is used. Red gumwood which shows an exceptionally pretty grain when varnished and polished makes up very nicely in a project of this kind.

The pedestal is to be turned up between centers while the base and bowl are examples of faceplate turning. If but one faceplate is available, the bowl should be turned first. The base should be left attached to the faceplate until the article is completed.

The inlay strip adds greatly to the attractiveness of the bowl, but may be omitted. To glue the inlay in place, use small spring clamps or C clamps to hold it while the glue is drying.

After the three parts have been turned and sanded, they should be assembled with glue and set aside until the glue has dried thoroughly, before attempting to finish the article.

Three or four coats of clear varnish or clear lacquer should be applied evenly with a clean brush to the entire surface of the article. Each coat of finish should be allowed to dry thoroughly and should be sanded lightly before applying the next coat. After the last coat of finish has dried, the entire finished surface should be sanded very lightly and polished by rubbing with pumice stone and oil applied with a soft cloth or a felt pad. The final luster is added by polishing with rottenstone. The best results are obtained if the polishing is done with the article revolving in the lathe.

TOOLMAKER'S CLAMP

E. C. Youngbluth and W. A. De Vette, Erie, Pennsylvania

All students who intend to follow the machinist or toolmaking trade will find the toolmaker's clamp a very necessary addition to their tool kit and others will find it usefui in the home.

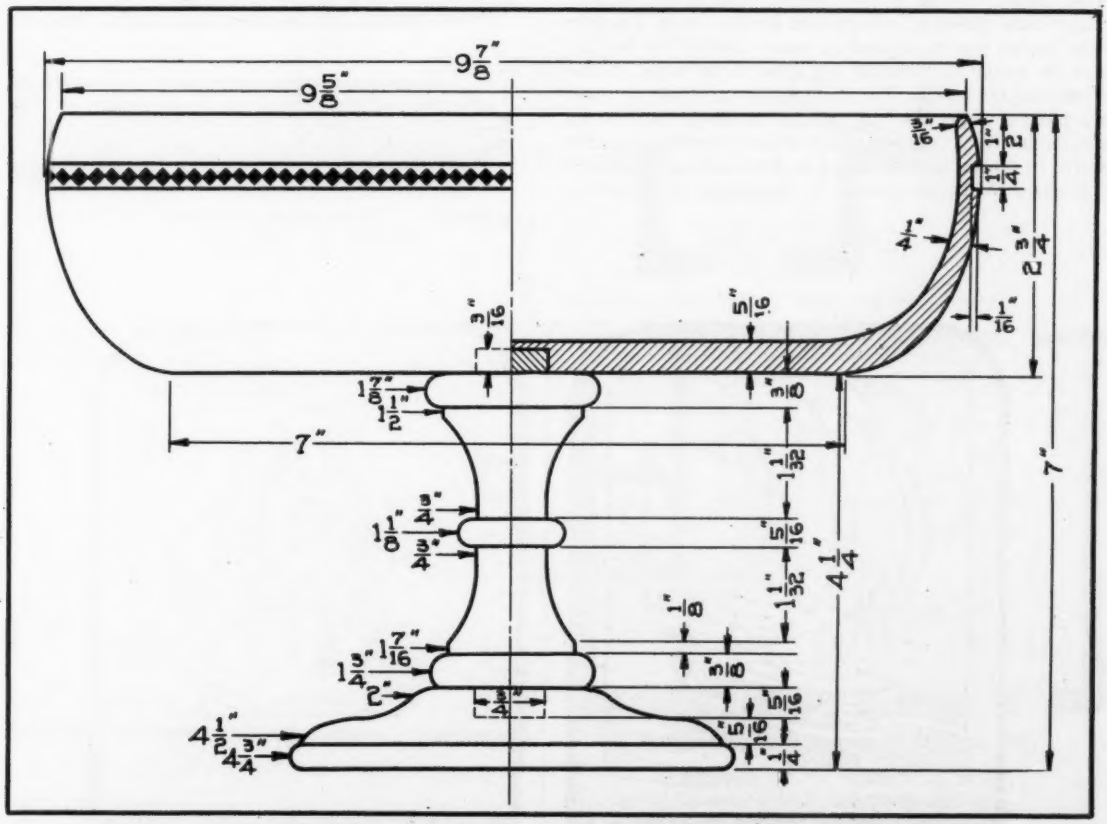
This project involves sawing and filing to a line and a curve, laying out holes, drilling, tapping, centering, facing, straight turning, knurling, and threading.

The material required for one clamp is two pieces of tool steel, ¾ in. in diameter by 3⅞ in. long and two pieces of key stock or tool steel, ¾ by ¾ by 4 13/16 in.

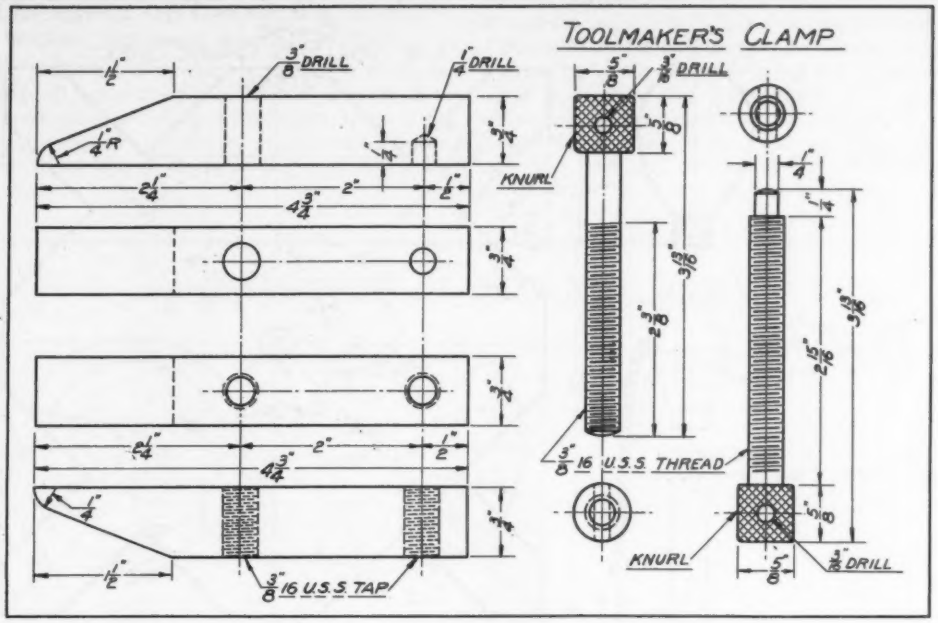
The order of operations is as follows:

Jaws

1. Cut to required length.
2. Drawfile.
3. Lay out and saw bevel.
4. File bevel and curve.
5. Lay out and drill holes.
6. Tap.



Fruit Bowl, Lemuel Harris, Nogales, Arizona



Screws

1. Cut to required length for turning.
2. Center and drill ends.
3. Face to length.
4. Straight-turn.
5. Knurl.
6. Straight-turn.
7. Turn offset.
8. Lay out and drill holes.
9. Thread.

ELECTRIC TABLE LAMP

Gerald A. Boate, Seattle, Washington

The lamp illustrated herewith is light in weight, simple in design, easy to make, and is so rigid that it will withstand rough use. All parts are made of light, easily procurable metals, some of which may be salvaged scrap.

The base is made out of a 12-in. square of No. 18 or 20 U.S.S. gauge black sheet iron or mild steel. After the piece has been laid out as shown, cut off all superfluous material and then smooth and slightly round all edges by draw-filing.

Drill a 17/32-in. hole in the center. Lay out and drill the 3/16-in. holes and also the ⅜-in. cord hole. Over a block of hard wood or bench edge bend downward the metal between the feet as shown in Figure B, then form the foot curves as shown in Figure A, using a piece of ¾-in. pipe and a heavy hammer for forming. All bends are made cold. Be sure that all bending is done uniformly so that the base will not rock when the feet are placed upon a level surface. The foot curves may be bent with the scroll outward or inward.

The scroll braces are fastened to the base with four 3/16 by ½-in. r.h. stove bolts.

Next a short, plain, ¼-in. cast-iron pipe coupling is sawed apart, and filed smooth and true. By placing one half above the base and tightening the other half against the base from below, a rigid joint is made.

The braces are made of four pieces of ⅛ by ½ by 8 in. band steel. The ends may be bent over a piece of pipe clamped in a vise, hammering downward on the steel strips until the curves are roughly formed. The four curves should all match. Center-punch and drill, using a 3/16-in. twist drill.

The standard is made of a piece of ¼ by 15-in. black gas or water pipe. An outside pipe thread should be cut for about an inch on one end using a ¼-in. right-hand pipe die. This end will be fastened to the base by means of the split coupling marked F in the illustration. After all inside burrs are removed from the hole at both ends, cut a ⅛-in. pipe thread, ⅜ in. long in the other end. This is for the close nipple marked C.

Use a brass finish, chain-pull socket, screwed firmly on the ⅛-in. nipple.

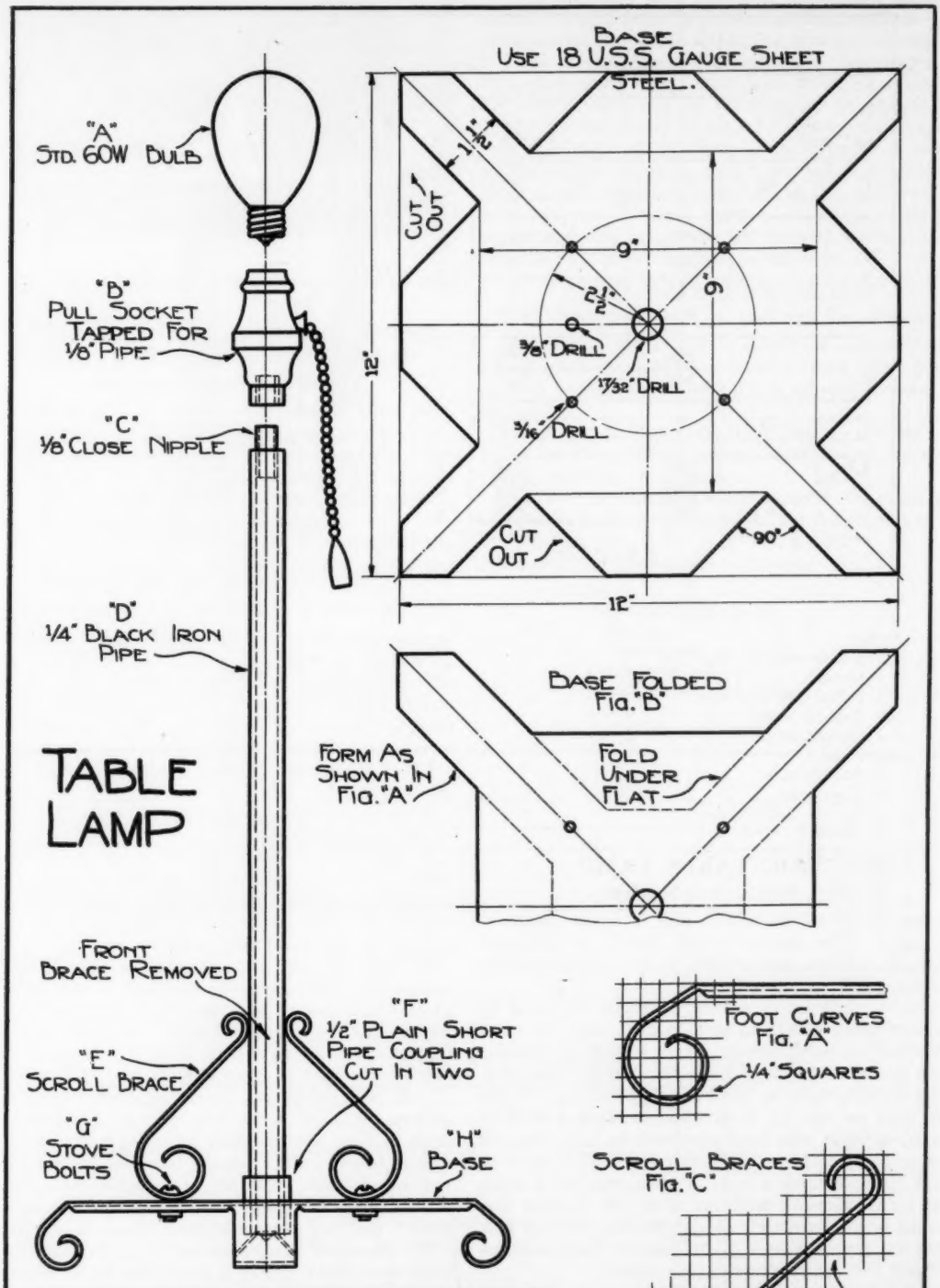
With the exception of the bulb and shade, this completes the list of parts needed.

In assembling be sure that the upper end of the scroll braces press firmly against the standard. A close fit may be made by bending with a monkey wrench. A lock washer placed beneath the base on each stove bolt before the nuts are screwed up will give a rigid joint.

To finish the lamp, first wash it in hot water in which soap powder has been dissolved. Then dry it thoroughly, after which a light coat of jesso should be applied. After 30 or 40 minutes this may be patted with a flat stick to work up a stippled effect. Then the lamp should be put away for a day to allow the jesso to thoroughly harden. Then apply a coat of gold paint mixed with banana oil. This will dry in about an hour, after which the lamp may be spotted with forest green, carmine, and sun glow. All of the colors are to be just spotted on with a soft brush and then patted with a clean, lint-free cotton cloth which has been formed into a ball. The patting causes the colors to merge. After these colors have dried, a final coat of clear brushing lacquer should be applied.

For the wiring, eight or ten feet of parallel-laid silk-covered lamp cord of gold, bronze, or green color will be required. This should be finished up through the standard and the ends wired to the socket terminal screws, after which the socket must be screwed firmly down on the close nipple. A knot should then be made in the cord just below the split coupling and the free end drawn upward through the cord hole in the base, insulating the wire at this point with an extra layer or two of rubber tape. Now attach the fixture plug, screw the bulb in place and test the wiring by attaching the lamp to a baseboard receptacle. The shade selected should be of the loop-wired type so that the curved loops may be slipped over the bulb.

This lamp has proved to be a very popular project with the eighth-grade boys.



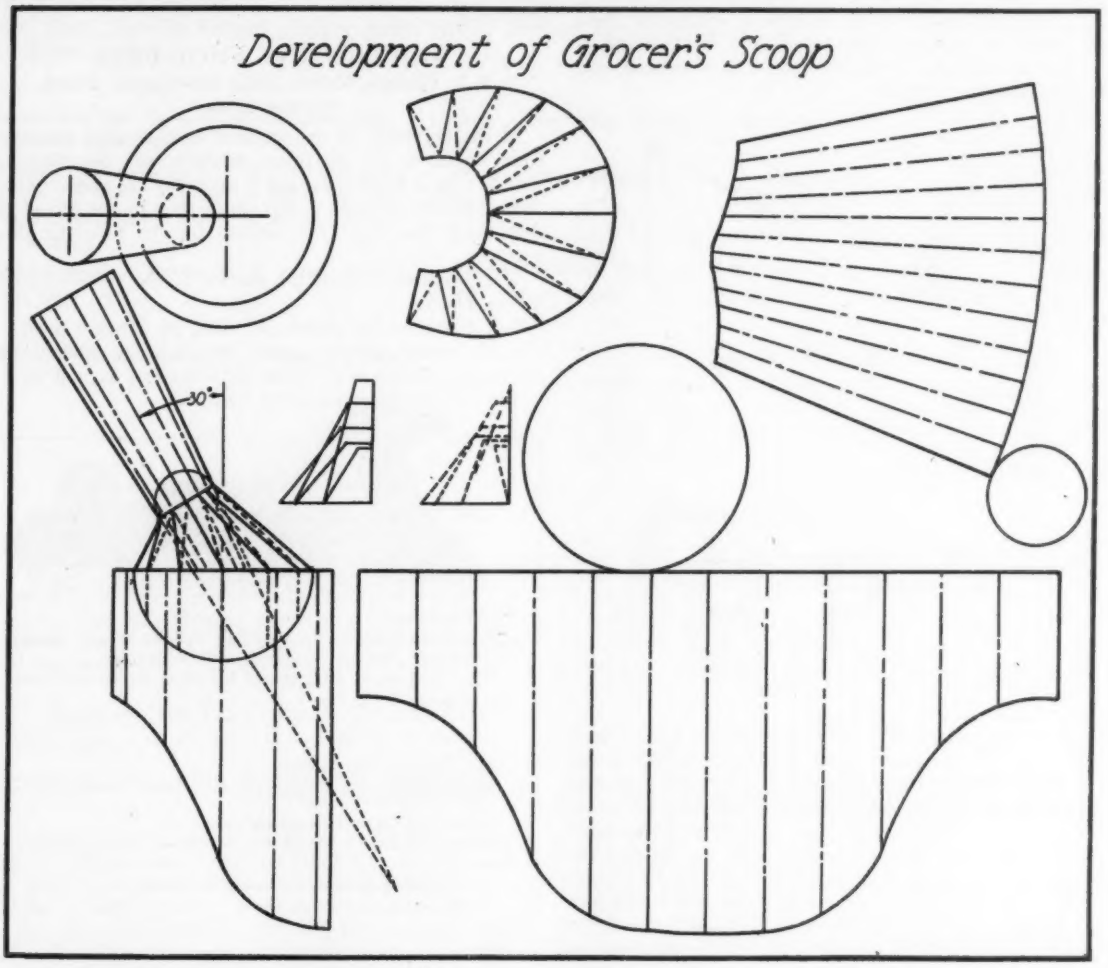
BILL OF MATERIAL

NO.	MK.	PCS.	NAME	MATERIAL	T.	W.	L.
1	A	1	LIGHT BULB				
2	B	1	SOCKET BRASS	SCREWED			
3	C	1	NIPPLE, CLOSE	CAST IRON	1/8		1
4	D	1	STANDARD	IRON PIPE	1/4		15
5	E	4	BRACES, SCROLL	BAND STEEL	1/8	1/8	8
6	F	1	COUPLING PLAIN	CAST IRON	1/2		1
7	G	4	BOLTS, STOVE	ROUND HEAD	5/16		1/2
8	H	1	BASE	SHEET STEEL	18 G.	12	12

DEVELOPMENT OF GROCER'S SCOOP

John McGrath, High School, Batavia, New York

One of the problems confronting the teacher is to choose projects which will arouse the pupil's interest. What pupil of sheet-metal work cares to develop a truncated cone by radial lines, an irregular edge of a cylinder by parallel lines, a transition piece by triangulation? He is interested in developing something useful.



The grocer's scoop, illustrated herewith, contains all of the three methods of pattern development in one problem. There will be no trouble in arousing the student's interest in developing this project.

The illustration shows the method of development employed.

TEACHING THEM THEIR P's AND Q's

J. E. Fintz, Assistant Supervisor, Cleveland Public Schools, Cleveland, Ohio

One source of grief for all printing teachers is training their students to identify the so-called "four demons," namely, the letters d, b, p, and q. All students experience difficulty in developing this ability, and as a result of their deficiency, the type case is seldom "clean."

Printers recognize the fact that a "dirty" case is one cause for errors in composition, and are resorting to all kinds of devices and methods to enable students to keep their cases in order. Many teachers unwittingly make this requirement a personal matter, and thus invite students to attempt all sorts of tricks in order to have their type case pass inspection.

Shopwork in the final analysis provides an opportunity for students to develop desirable habits and attitudes, which will be an asset after they leave school. The importance, and reason for careful distribution of type into a type case is largely if not wholly a matter of attitude, while exercising care, and practicing accuracy is habit. John Dewey defines education as "Growth of conduct in meaning." When an act is understood in terms of attending consequences, our conduct and reactions assume "meanings." Thus Dewey's definition of education applied to type distribution means that a type case should be kept in a clean condition because:

1. A student who is careless about his type case and who deliberately mixes it up, is taking an unfair advantage of the other students who follow him. Because of his attitude he denies those who follow, an equal opportunity to succeed, and destroys their interest in something, which under proper conditions would be profitable and instructive.
2. A mixed or dirty type case increases the time required to set a job.
3. A type case in poor condition is responsible for errors in composition.
4. Errors in composition are time-consuming factors.
5. Time consumed in making corrections increases the cost of production and causes unnecessary delays.
6. Increased costs in production reduces profits.
7. Increased costs in production make competition more difficult and are responsible for decrease in business.

8. Lack of business is responsible for unemployment and other business ills.

In attempting to develop right attitudes and habits a wise teacher always minimizes the difficulty and exaggerates the importance. To distinguish the letter b from the letter d is not difficult, but very important. The ability to identify one from the other is a factor that determines either a *clean* or a *dirty* type case.

Many methods have been employed by printing teachers to develop in the students the ability to isolate d's, b's, p's, and q's, and usually the results are far from gratifying or satisfactory. The method to teach students to distinguish these letters from one another, recently adopted in Cleveland, is rather simple, and the results obtained with it indicate that it is decidedly worth while.

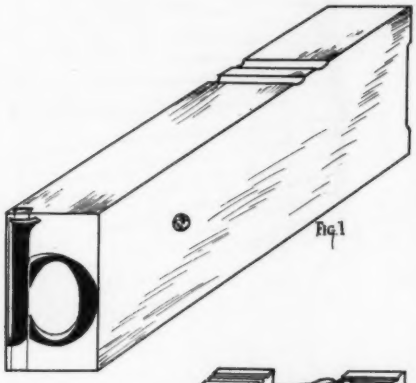


Fig 1

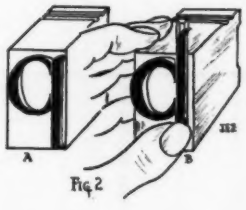


Fig 2

Large models of the four letters d, b, p, and q were made in one of our pattern shops. These were made in such a way that the vertical element is loose and slides in the groove as shown in Figure 1. The models were then painted black except that the face of the letter itself is finished with aluminum paint. The instructor holds the model letter, face toward the students, and calls their attention to the fact that he is holding it with the nicks up, in the same way that they would pick it out of the type case. He then asks them what that letter looks like. If a letter d is shown by the teacher, the reply by the students is that it looks like a letter q, which is correct. (See Fig. 2A.) The teacher then moves the vertical element upward as shown in Figure 2B, and repeats the question. This time the answer is that the letter looks like a d. The same procedure is followed with the other three letters, and as a result of this demonstration a principle is formulated which may be stated as follows:

Hold the letter, face toward you, with the nick up. Imagine that the vertical element on the letter is moved in the opposite direction from which it appears. The letter is then seen correctly.

This *one* principle holds good for the four letters and the problem of learning how to distinguish them is much simplified to the student.

To demonstrate the value of this teaching device, the following experiment was tried: Two hundred and twenty-four students were taught to distinguish the "four demons" by the methods taken from two well-known texts, for a period of three weeks. A specific amount of time was devoted to this problem every day. At the end of this period each student was given an envelope which contained a quantity of each one of the four letters, and students were required to list on a blank provided, the number of b's, d's, p's, and q's in the envelope. The results of this test produced a class average of 85 per cent.

In order to test the advantage of the new method, another group of 288 students were given the same instruction, using devices shown in Figure 1, 2A, and 2B. At the end of one week's time this group was given the same test, with a resulting class average of 90 per cent. The percentage gained is relatively small, but when one considers that the old method required practically two thirds more time, the results are very gratifying.

COLLECTING SHOP FEES

R. L. Grandle, Morace Mann Intermediate School, Wichita, Kansas

At the beginning of the semester each student receives a form similar to the one shown herewith with the directions that he take it home and have it signed by the parent. These forms must be returned to the school shop by the end of the first week. The form was devised for the following three reasons:

1. To properly inform the parents of the correct amount of the shop fee.
2. To acquaint the parents for what the fees are used.
3. To protect parents against unscrupulous children who frequently ask for more money than the fees amount to.

The method has worked out very well.

WICHITA PUBLIC SCHOOLS
DEPARTMENT OF INDUSTRIAL EDUCATION
HORACE MANN INTERMEDIATE SCHOOL

Dear Patron:

Your son is enrolled in ———————. The fee in this course is $ ———.

This is used to pay for materials that he will use during the semester. There is no refund on the above fee.

There will be an extra charge for all materials used over the amount of the fee.

Signed ——————— Instructor.

. . . . . .

Please tear off and return at once.

Student's Name ———————

Teacher:

I am sending $ ——— with this note.

I will send $ ——— about ——— 193—
date

Note:

Partial payment may be made at any time if it is more convenient.

Remarks:

Signed ———————
Parent or Guardian

MODERNISTIC BOOK ENDS

Louis F. Barocci, Cudahy High School, Cudahy, Wisconsin

The modernistic book ends shown herewith make interesting projects for junior-high-school boys. Any kind of wood may be used in constructing them, and the project may be finished natural or in colors to suit individual tastes.

The book end shown may be changed to suit the taste of the student, thus affording much opportunity for individuality

(Continued on page 84)

The Stanley Rule & Level Plant

Educational Department, New Britain, Conn.

Manufacturers of

Stanley Tools

Stanley Tool Catalog No. 34A with School Index

Instructors of the following shop subjects should have this most complete reference book on school tool equipment. Quality tools are economical and necessary. They stand up longer under the hard and accelerated usage of the school shop. Specify Stanley quality tools. Write for our recommendations and Stanley Tool Catalog No. 34A with School Index.

Woodworking and Farm Shop—The most complete line of hand tools.

The school index will aid you to select the best tools for the school shop. It is keyed for the various schools, and a choice is mentioned for many items.

Electrical Shop — Hammers, bit braces, screw drivers, etc.

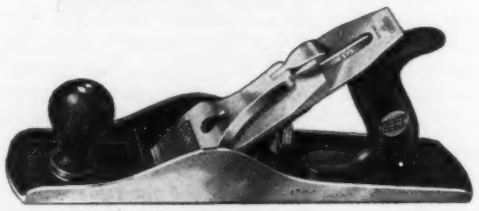
Sheet Metal Shop—Hammers, chisels, punches, etc.

Machine Shop—Hammers, rules, chisels, punches, levels, etc.

Forge Shop—Anvil tools, tongs, hammers, etc.

Automobile Shop—Body and fender tools, hammers, chisels, punches, pliers, files, etc.

Stanley "Junior" Jack Plane



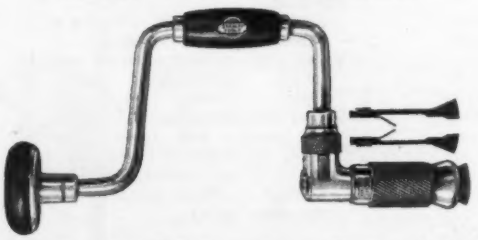
An intermediate size between the smooth and jack plane. Considered the ideal size for Elementary and Junior High School shop work. No. 5¼, 11½" long, 1¾" Cutter.

Stanley "100 Plus" Screw Drivers

The strongest wood handled screw driver made. Recommended for use where screw drivers are subject to abusive treatment. Built to withstand an unusual amount of prying and pounding.

No. 1001 made in 3", 4", 5", 6", 8", 10", and 12" sizes.

Stanley "Boy Proof" Bit Brace



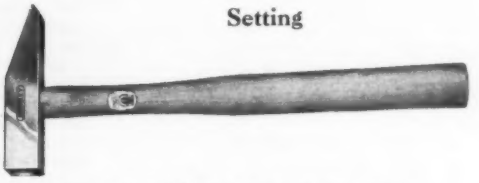
The most "boy proof" brace we can offer to schools. Designed to hold the square shanks common to auger bits. Bit centers itself in a square socket—a distinct advantage for school work. No parts can be easily removed. Head turns on ball bearings and a bronze bushing.

No. 919 made with 6", 8", 10", 12", and 14" Sweeps.

Stanley Handled Hammers

Stanley offers a complete line of all types and sizes of hammers. They are forged from selected steel and super heat treated. The handles are processed to assure their remaining tight in the heads.

Setting



No. 452. 12 oz., Size 3. Other sizes 8, 16 and 20 oz.

Ball Pein

No. 310. 16 oz., Size 0. Other sizes from 2 oz. to 56 oz. heads.

Stanley Light Weight Tongs

We offer you a special line of Light Weight Tongs designed for the school shop.

Hand Cold Chisels

Made from electric furnace chrome vanadium alloy steel, and tempered so that they are tough enough for the hardest work yet can be resharpened with a file.

No. 99. ¾" stock, ⅞" bit, 7½" long.
Also 5 other sizes, ⅜", ½", ⅝", ⅞", and 1" stock.

"Stanley Equipment is Standard Equipment"

Woodworking Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.
Benches	
Hardwood tops, 1¼ in. or over in thickness, built up of strips with tongue-and-groove joints, the top to project far enough to allow a rapid-acting or continuous screw vise to be attached. It is a good idea to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type	
Glue	
Stain, with metal-covered top	
Teacher's Demonstration....	
Blackboard	
Permanent or portable	
Bookcase	
For reference books, catalogs, etc.	
Bulletin Board	
Cabinets, wood or metal for filing class records, instruction sheets, drawings, etc....	
Chairs	
Tablet-arm chairs	
Core Oven (for patternmaking class only)	
Desk	
Teacher's, with drawer compartments	
Chair, to match desk..... ..	
Furnace, for melting soft metals (for patternmaking class only)	
Glue Pot, 1-qt., or 2-qt. size, electric, gas, or steam heat..	
Glue Warmer or Cooker	
1 to 5 gal. capacity.....	
Grinder	
Automatic knife, direct motor-drive type. Size to suit largest knife used in the school shop. Grinder to be complete with water pump, grinding wheel, and automatic stops	
Bench, hand or power.....	
Bench, motor-in-head. Motor bearings to be completely housed. Wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel	
Revolving oilstone, pedestal type, with one fine and one coarse oilstone	
Jointer	
6- or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, and equipped with safety guard	
12-, 16-, or 18-in. direct motor-drive, ball-bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard	
Lantern	
Stereopticon-view machine for opaque objects and standard-type lantern slides	
Lathes	
6- to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block...	
Patternmakers, with end faceplate provision. Lathe to be of direct motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class only).	
Mortiser	
Direct motor, or belt driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod.....	
Portable, vertical, hollow-chisel mortiser, bench type	
Planer	
12-, 18-, 20-, 24-, or 30-in. motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife setting and jointing device complete with bar should be mounted on machine if possible	
Saws	
Band Saw, 20- to 36-in. motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.	
Combination, band saw, crosscut saw, rip-saw, and mortiser. Machine to be completely guarded	
Cut-off, pedestal or swing type to be fitted with 12- to 16-in. saw	
Filing machine, direct motor-drive	
Jig, direct motor or belt-driven	
Portable band saw, 16 to 20-in. ball-bearing, motor driven	
Saw bench, direct connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided	
Universal saw bench, 14 to 16-in., motor driven	
Variety saw bench, motor-driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cut-off gauges	
Sander	
Belt, direct motor-drive.....	
Disk, motor or belt driven...	
Oscillating-spindle, motor driven	
Portable, hand-plane type. Direct motor-drive	
Verticle-spindle and disk sander	
Shaper	
Motor-drive, single or double spindle. Table to be equipped with removable center plate.....	
Portable shaper or router with a suitable selection of cutters	
Tenoner	
Single end, with coping heads and cut-off saw	
Vises, rapid-acting or solid-nut type woodworking bench vises, 7 to 10-in. face.....	
Wood Trimmers, complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings. (For patternmaking class only).....	

Woodworking—Small Tools

Name and Description	No.
Awls, Brad, assorted sizes.....	
Bevels	
Protractor	
Sliding T, 8"	
Bits	
Auger, 1/16" to 1" inclusive by 16ths, each	
Auger, 1/16" to 1/2" inclusive by 16ths, each	
Braces, ratchet type, 8", 10", 12" or 14" sweep.....	
Countersink, for wood, rose	

(Continued on page 76)

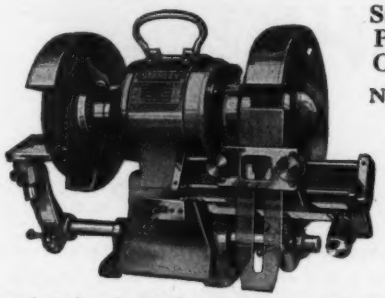
The Stanley Electric Tool Company

Educational Department, New Britain, Conn.

Manufacturers of

Stanley Portable Electric Tools

Stanley Electric Tools are made to the same careful standards as Stanley Hand Tools which for 80 years have maintained an enviable reputation for high quality. Briefly some of the features of Stanley Electric Tools are: straight line, compact design; will operate continuously all day at full rated capacity without overheating; powerful motors, with large reserve capacities; gears cut from nickel alloy bar steel; best ball bearings obtainable assure long trouble-free performance; chuck key securely fastened in a recess in the drill where it is always handy; equipped with extra heavy, rubber-covered cable fastened so there is no strain on connections.



Stanley Electric Plane Iron and Chisel Grinder

No. 567—7" Wheels

Designed for the woodworking shop. A grinding attachment holds all sizes of plane irons and chisels so that any boy can grind a perfect bevel. Equipped with special tool grinding wheels. Ball bearing motor operates at slow speed of 1725 R.P.M. Equipped with Safety wheel guards. If desired can be furnished with safety glass eye shields.

For A.C. 110 volts and D.C. 115 volts.

Stanley Portable Electric Drills

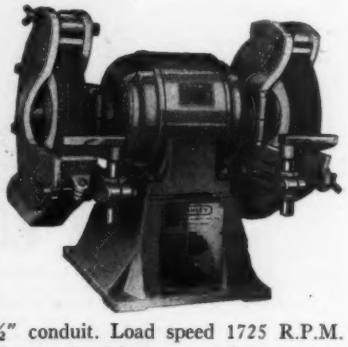
Pipe handle and pipe handle casting are removable, permitting Drills to be used in small spaces.

No. 121—½" Standard Duty. A popular drill for the machine, electrical and automotive shop. Capacity ½" in steel, 1⅜" in wood. Full load speed 275 R.P.M.

No. 582—⅝" Heavy Duty for heavy drilling in the automotive and machine shop. Capacity ⅝" in steel, 1⅝" in wood. Full load speed 250 R.P.M. Voltages 110, 150, 220 or 250 as specified.

Stanley Electric Bench Grinder

No. 610—¾ H.P.—10" Wheels

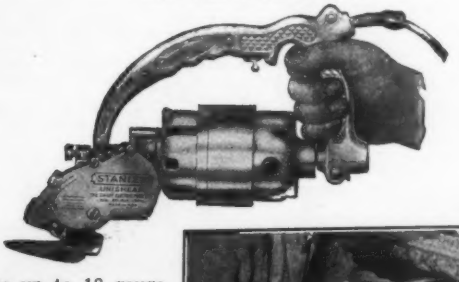


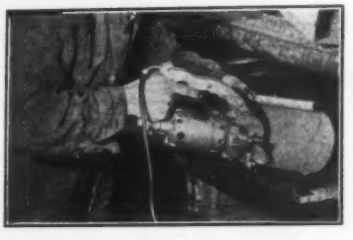
A smooth-running, vibrationless grinder for the automotive and machine shop. Furnished with 1 coarse and 1 fine wheel, adjustable tool rests, exhaust type wheel guards, with adjustable dust shields, and conduit box for ½" conduit. Load speed 1725 R.P.M. on 30 and 60 cycles. Can be furnished mounted on an iron floor pedestal, order No. 1610.

Write for motor specification.

Stanley "Mighty Midget" Unishear

A motor driven shears





Cuts up to 18 gauge iron, 16 gauge aluminum, etc., also leather, fibre, cardboard, etc., up to 15 feet per minute. Weighs only 6½ lbs. and is easier to handle than a pair of snips. 100% safe. Cuts straight lines, curves, angles, and notches with hair-line accuracy. Universal motor. Voltages 110, 150, 220, or 250 as specified.

Stanley Portable Electric Drill No. 142—¼" Heavy Duty, and Stanley Drill Stand No. 532

Combined they make an efficient and economical piece of shop equipment for all kinds of bench drilling. By loosening the thumb screw, the drill can be quickly released to use as a portable drill. Drill No. 142—¼". Heavy Duty has a capacity of ¼" in steel—and 1" in wood. Full load speed 750 R.P.M. Universal motor. Ball bearing supported motor and chuck spindle. Can be furnished for 32, 110, 150, 220 or 250 volts as specified.

Send for This Catalogue!

It describes the full line of Stanley Electric Drills, Drill Stands. Bench and Pedestal Grinders, Sheet Metal Cutting Tools, Wood and Stone Saws, Hammers, Screw Drivers and Accessories.

"Stanley Equipment is Standard Equipment"

The Stanley Electric Tool Company, Educational Department, New Britain, Conn.

American Saw Mill Machinery Company

Hackettstown, New Jersey

New York Office, 50 Church St. Philadelphia Office, 134 North 3rd St.

Manufacturers of

"Monarch" Woodworking Machines and Allied Lines

This Company is engaged in five distinct branches of manufacture, viz., Woodworking Machinery, including Lathes, Planers, Jointers, Band Saws, Resaws, Sanders, Mortisers, Saw Tables, etc.; Saw Mill and accessory equipment for lumber manufacturing; Contractors' equipment including Contractors' Saws and Hoists; Circular Saws of all sizes; Grinding equipment for knives of all kinds, Lawn Mower Grinders and Saw Sharpeners for circular and band saws. The machines described herein are more particularly adapted for use in **manual training schools.**

Four Speed Head Stock M. T. Lathe No. MMT

Fig.1115

THE MOTOR HEAD STOCKS are fully enclosed for, 2 or 3 Phase, 60 Cycle, 220 Volt Current only, having four speeds, of approximately 600, 1200, 1800 and 3600 R. P. M. The Motor is ½ H. P. at the lowest speed developing more horsepower at the higher speeds.

THE CONTROL is a four speed lever control attached to the bed beneath the Motor. This is within easy reach of the operator and the various speeds are indicated by a dial. A Magnetic Switch with Push Button, having overload and undervoltage protection is furnished. The Motor can be started only on low speed but can be stopped at any speed by the push button.

HEAD STOCK SPINDLES are threaded at both ends for face plates. The Motor Head Stock is fitted with a 7" combination hand wheel and face plate at outer end of spindle which may be removed when large face plate is used. The Motor is provided with a convenient locking device for removing face plates.

TAIL STOCK is of box design with screw spindle having 5" range of travel. It is fitted to the bed and secured by a quick acting eccentric clamp.

THE TOOL REST regularly furnished may be adjusted up and down and to and from the work. It will swing any angle and is locked to the bed by an eccentric clamp.

FIG. 1138

No. M.M.T. with Cabinet Type Legs.

Specifications

Swings over Bed	12"
Swings over Tool Rest	8¾"
Movement of Tail Stock Spindle	5"
Height to top of Bed	37"
Height to center of Spindle	43"
Spread of Legs on Floor	20"
Length of Bed	50", 62", 68", 74", 87", 99"
Distance between centers	24", 36", 42", 48", 60", 72"
Net Weight, Lbs.	550, 590, 610, 630, 670, 770
Shipping Weight, Lbs.	650, 690, 710, 730, 770, 880

Regular Equipment

1—¼" spur center
1—½" cup center
1—conical center
1—2½" screw chuck
1—6" face plate
1—6" angle rest
1—6" "T" rest
1—12" "T" rest
1—drift rod
1—7" combination hand wheel and face plate on outer end of arbor.

Extra Equipment on Order

Hand feed carriage with compound tool rest (travels entire distance between centers) with Offset Tail Stock. Floor Stand and 14" face plate for outside turning.

No. 65 Variety Tilting Table Saw

This is a machine especially designed for fine and accurate cutting. The saw is mounted directly on the motor arbor and is moved vertically by means of wheel and screw. The iron table is 38" x 44" and tilts to 45°. It is fitted with rip and cut off guides with adjustable length gauge. A removable throat plate admits using jointing, grooving and rabbetting heads.

REGULAR EQUIPMENT: One 16" rip saw projects 3¾" above table, ripping gauge, cutoff gauge with reach rod and stop.

EXTRA EQUIPMENT: Hollow chisel mortising and boring attachment or separate boring attachment. Saw speed is 3450 R.P.M. Weight of machine 1250 lbs.

Fig. 1106

Tilting Arbor Saw Bench No. X24

The table is 32"x28" and is fitted with rip and cut off guides with adjustable length gauge. Saw when vertical projects through table 3½" and 2½" when inclined 45°.

The right hand table is fixed, but the left hand table is adjustable and may be locked in any position by two hand nuts.

The saw is mounted directly on the motor arbor and may be tilted to 45° to the vertical by means of hand wheel and screw; the degree of the angle being registered on a scale. The saw may be lowered beneath the table or raised through the table; when in either a vertical or angular position, by means of a handwheel and screw. By using the graduated cut-off gauge and the scale of the tilting saw, any desired compound angular cut may be made, the stock during this operation being supported by a perfectly level table. Arbor Extension for 2" Dado Head, 1½" Hole, can be furnished at extra cost.

FIG. 1125

Regular Equipment

1—16" Novelty Saw
1—Ripping Gauge
1—Cut-off Gauge
1—Splitter

Selection of Motors:
1—2-H.P., 1, 2, or 3 Ph., 60 Cy., or D.C. Motor and Starting Switch
1—3-H.P., 2 or 3 Ph., 60 Cy. Motor and Starting Switch.

Hollow Chisel Mortiser No. X1

This Mortiser is designed for light mortising in hard or soft woods and is an ideal machine for the School Shop. It is a well made tool and is free from vibration. The chisel is held rigidly at all points of stroke and will mortise 3½" deep with ½" chisel in hardwood, or with ⅝" chisel in softwood; and will bore 4" deep with ¾" bit and is easy to operate.
¾" hollow chisels may be used.

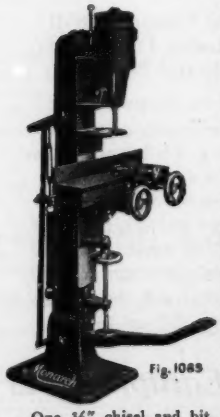


Fig. 1069

Specifications

Dist. End of Chisel to table top (max.)	13"
Adjustment of depth stop	4"
Vertical travel of chisel	4"
Dia. of hole in spindle for bits	½"
Dia. of hole in chisel ram	1⅝"
Shipping weight	530 lbs.
Height over all	66"
Floor space	36"x40"
Length of Table	24"
Width of Table	6"
Vertical Adjustment of Table	12"
Travel of table in and out	4"
Travel of table lengthwise	12"
Travel of table clamp	3¼"
Dist. Center of Chisel to back stop (max.)	4¾"

One ¾" chisel and bit, two bit bushings and two chisel bushings and one ½ H. P. Motor, 3600 R. P. M., are furnished with each machine.

American Saw Mill Machinery Company—Continued

Single Spindle Shaper No. X19

FIG.1126

The No. X19 Machine is especially suited for the school or woodworking shop desiring a high grade, high speed, single spindle Shaper. It is designed so as to receive a one or two-horsepower motor and is intended for light as well as heavy shaper work. It will cut without reversing, against, across, as well as with the grain. The high speed spindle (10,000 R. P. M.) eliminates the necessity of reversing as required in the slower speed Machines.

Specifications

Diameter of Spindle below the Table .....1 11/16"
Diameter of Spindle above the Table .....1"
Distance Between Shoulder and Nut .....4"
Size of Spacing Collars:
1—7/16 Outside dia. x ¼"
1—7/16 Outside dia. x ½"
1—7/16 Outside dia. x ¾"
1—7/16 Outside dia. x 1"
2 Chuck Collars 2¼" x ¾"
3¼" Vertical Adjustment of Spindle
15½" Distance from Front edge of Table to center line of Spindle
18" Distance from side edge of Table to center line of Spindle
36" Height from Floor
3" Width of Driving Belt
Shipping weight, 720 lbs.

26" x 36" Size of Table
4¼" Diameter of Hole in Table
2¾" Diameter of Hole in Rings
7" x 3" size of Driving Pulley
2½" x 3" size of Spindle Pulley
10,000 R. P. M. Speed of Spindle
3600 R. P. M. Speed of Motor
Motors: Ball Bearing, 1 or 2 H. P. for 1, 2 or 3 Phase or D. C. Current

Single Surface Planer

16 in. and 20 in. sizes

This planer is designed to meet the needs of School Shops and those requiring a light but good, strong, durable single-surfacer for general work at a low price. It is built throughout of the best grade iron and steel. Its simplicity, compactness and large capacity in proportion to its size, has made it very popular. It is built in two sizes to plane up to 16" and 20", to plane from ¼" to 6" thick. Furnished with 3 H. P. Direct Connected Motor.

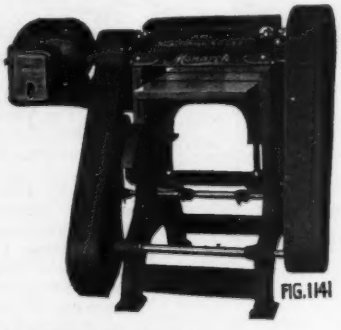


FIG.1141

Specifications

Size:	16"	20"
Width will Plane:	16"	20"
Thickness will Plane:	¼" to 6"	¼" to 6"
Speed of Cutterhead:	3600 RPM	3600 RPM
Weight:	860 lbs.	885 lbs.

6" and 8" Bench Jointers

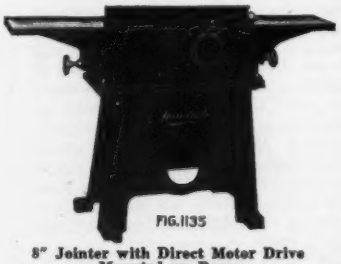


FIG.1135

8" Jointer with Direct Motor Drive Mounted on Base.

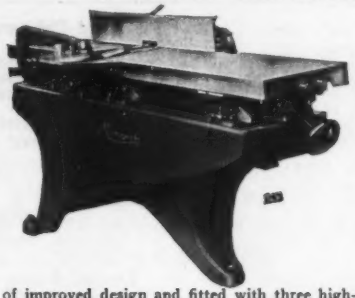
These Jointers are made in six-inch and eight-inch sizes, with safety round heads fitted with high speed steel knives. Heads are mounted in separate yoke and run in high grade ball bearings. They have all of the adjustments of large jointers and are built with exceptionally long, rigid tables and are guaranteed for close work. Both the six-inch and eight-inch machines are regularly equipped with rabbeting arms and aluminum guards of the swinging type. Either machine is arranged for Belt Drive or Direct Motor Drive by means of flexible Coupling or Shaftless Motor.

The Motors regularly furnished are for 110-220 volt, 60 cycle, single-Phase, or, 60 cycle, three-Phase. Two-Phase or Direct Current Motors are furnished on special order.
Machines furnished with or without floor Pedestal (Fig. 1135).

Specifications

No.	X15	X13
Size	Six Inch	Eight Inch
Floor space with motor	23½" x 38"	37" x 60"
Feeding-in table	8" x 18"	10" x 29¼"
Feeding-out table	6¼" x 18"	8¼" x 29¼"
Height to working surface	8¼"	10½"
Height to working surface mounted on stand or column	35¼"	34"
Length and height of fence	20" x 3½"	24" x 3½"
Diameter and length of head	3" x 6"	4" x 8"
Speed of cutter head	3450-3600	3450-3600

12" and 16" Ball-Bearing Jointers



A new design embodying the ideas of eminent woodworking experts and designers. Three point floor contact gives clear foot room for operator. Feed in table 48" long; feed out table, 36" long. Safety guard adjusts itself to any width of work passing through. Entirely out of way for rabbeting without removing from machine. Fence actuated by cut rack and pinion and can be clamped in place. Tilts to any angle from 45° to vertical. Head is direct motor driven; is 5" in diameter, of improved design and fitted with three high-speed knives.
Principal dimensions—89" length overall; 38" width overall, including motor and rabbeting arm; 44" width overall for 16" jointer; ¾" depth of rabbeting groove; weight of 12", 1,600 lbs.; of 16", 2,000 lbs.

No. 72—20" Band Saw

Here is a band saw of the latest approved design, built to meet the most rigid requirements of safety regulations. Every moving part is fully guarded, except the portion of saw blade in the cut.
The UPPER WHEEL is mounted on ball bearings, the best type obtainable, and applied to arbor making its lubrication a simple matter.
The LOWER WHEEL is mounted directly on the motor shaft, allowing the maximum of power for useful work.
Motors of ½, ¾ and 1 H.P. may be used and furnished for the following electric currents.
110, 220, 440-volt, 2 and 3-phase, 60-cycle, 875 R.P.M.
550-volt, 3-phase, 60-cycle, 875 R.P.M.
550-volt, 3-phase, 25-cycle, 715 R.P.M.
110, 220, 440-volt, 2 and 3-phase, 25-cycle, 715 R.P.M.
220, 440, 550-volt, 3-phase, 50-cycle, 970 R.P.M.
110, 220-volt direct current, 850 R.P.M.

Regular Equipment

¾" Saw Blade, 11'-6" long.
Roller Saw Guide.
Brazing Tongs.
½ H.P., 3-phase, 60-cycle, 875 R.P.M. Ball Bearing Motor.

No. X25—30" Band Saw

Fig. 1100

All moving parts are entirely inclosed except portion of the saw between table top and saw guide.
Guarding inclosure of upper wheel moves up and down with the wheel and its front can be swung open on hinges to allow free access to wheel for assembling saw blade.
Blade is tracked and tension adjusted by hand wheels so placed as not to interfere with the capacity height of machine.
Frame is iron cast in one piece shaped for rigidity, appearance and non-interference with capacity stock.
Cast iron spoked wheels are used with rubber bands.
The front of the lower guard consists of a door which may be swung open allowing free access to wheel and lower guide.
All guards are sheet metal with angle frames.
Upper wheel is ball bearing.
The lower wheel is mounted on the shaft of a ball bearing motor.
The table is tilted in either direction and locked in any position by means of a hand wheel, degree of tilt being indicated by a scale.
REGULAR EQUIPMENT:
½" saw blade 16'-8" long.
Upper and lower roller guide for saw, ripping guide.
2 H.P. Motor, 575 R. P. M. Full load.

The American Saw Mill Machinery Company are also manufacturers of swing cut-off saws of either wood or metal frames and either direct motor drive or belt drive—combination rip and cross-cut power saws—variety woodworkers combining saw, jointer, mortiser, borer, and also bandsaw, equipped either with power built in or without—universal saw benches with saws up to 14" in diameter—tilting table bandsaws 20, 27, 30, and 36"—single and double spindle shapers—tenoners—post boring machines and planers or surfacers of 16, 20 and 24" width.

(Continued from page 72)

Name and Description	No.
pattern, ½" and 5/8", each	
Dowel, square shank, ¼", 5/16", 3/8", ½", ¾", each	
Expansive, 7/8" to 1½"	
Expansive, 7/8" to 3"	
Forstner, square shank, ¼" to ½" inclusive, by 16ths, each	
Screw Driver, square shank, ¼", 5/16", 3/8", each	
Twist Drill for wood, square shank, 1/16" to 3/8" inclusive by 16ths, each	
Twist Drill, straight shank, 1/16" to 3/8", inclusive by 32nds, each	
Blow Torch	
Brooms	
Brushes	
Bench Duster, 10"	
Glue, round, ½" and ¾", each	
Glue, round, 1½"	
Marking, camel's hair, No. 1 and No. 2, each	
Varnish, flowing, 2"	
Varnish, flowing, 2½"	
Varnish, flat, ½"	
Varnish, flat, ¾"	
Varnish, flat, 1"	
Burnishers, oval or round	
Calipers	
6", outside	
6", inside	
12", outside	
12", inside	
Can Opener	
Carving Tools	
Sets containing 6 tools	
Sets containing 12 tools	
Chisels	
Cold, machinists', 3/8" and ½", each	
Mortising Chisel and Bits, ¼" to 5/8" by 16ths, each	
Socket-firmer, bevel edge, ½", 1", and 1¼", each	
Socket-firmer, bevel edge, ¼", ½", and ¾", each	
Socket-firmer, plain edge, ½", ¾", and 1", each	
Tanged-firmer, bevel edge, 1/8", ¼", ½", ¾", 1", and 1¼", each	
Clamps	
Screw, adjustable, 24", 36", and 48", each	
Screw, adjustable, 60"	
Tilting Saw	
Dividers, Wing, 6" and 10", each	
Doweling Jigs, with bushings	
Dowel Plate, 6" long	
Drawknives, 7"	
Drill	
Automatic Hand, with 8 drill points	
Chuck, 0 to 3/8"	
Hand, 0 to 3/8", for round-shank drills	
Star, for concrete, ½" and ¾", each	
Files	
Auger Bit, assorted 6"	
Cabinet, 8" and 10", each	
Card and Brush	
Flat, wood 10"	
Mill, bastard cut, 10"	
Round, bastard cut, 12"	
Taper, slim, 5½" and 7", each	
First-Aid Cabinet and Supplies	
Floor Brushes	
Gauges	
Bit, adjustable	
Jointer	
Marking, metal or hardwood	
Mortise, metal or hardwood	
Panel	
Glass Cutter	
Gouges	
Tanged firmer, outside ground, handled, 1/8", ¼", ½", ¾", 1", each	
Tanged-firmer, inside ground, handled, 1/8", ¼", ½", ¾", 1", each	
Spoon, ½", ¾", and 1", each	
Hammers	
Claw, bell-faced, 10 oz	
Claw, bell-faced, 12 oz	
Claw, bell-faced, 13 oz	
Claw, bell-faced, 16 oz	
Hand Screws	
Adjustable, length of jaws, 4", 5", and 6", each	
Adjustable, length of jaws, 7", and 8", each	
Adjustable, length of jaws, 10", 12", and 14", each	
Hatchet, Bench, 4" cut	
Jars, Earthenware, 1-qt. capacity	
Knives	
Jointer, to fit power machine	
Planer, to fit power machine	
Sloyd, 3" blade	
Levels	
Wood, 24"	
Machinists', 12"	
Mallets, Hickory, 3" by 5" head	
Nail Sets, Point, 1/16" and 1/32", each	
Oilers, Bench, ½ pt. coppered, best grade	
Oilstones	
1"x 2"x 8" in iron box	
Gouge Slip, medium, 4½"x 2 3/8"x 5/8"x 1/16"	
Gouge Slip, fine, 3"x 2"x 3/16"x 1/8"	
Pincers, 6" carpenters'	
Planes	
Block, adjustable, 6" long, 1 5/16" cutter	
Circular	
Combination, adjustable	
Core Box	
Duplex, fillister and rabbet	
Fore, 18", 2 3/16" cutter	
Irons, double	
Jack, 14", 2" cutter	
Jointer, 24"	
Round, wood, 1¾"	
Router	
Smooth, 9", 1¾", or 2" cutter	
Pinch Dogs, ¾", 1", and 1¼" each	
Pliers	
Round-nose, 5"	
Side-cutting, 6"	
Putty Knives	
Rasps, half-round, wood, 10"	
Rules	
Board	
1' or 2' graduated by 8ths and 16ths	
Shrink, 1/8", 1/16", each	
Saws	
Back, 12", 14 point	
Band, ¼", ½", ¾", to fit power machine, each	
Compass, 10"	
Coping, frames	
Coping, blades	
Crosscut, 9-tooth, 22" long	
Crosscut, circular for power machine	
Dado, 1/8" to 1 1/16" to fit power-saw arbor	
Hack, frames, 8" or adjustable	
Hack, blades, 8"	
Keyhole, 10", 10 point	
Rip, 7 point, 22" long	
Rip, circular for power machine	
Set, 10 points per inch and finer	
Set, 10 points per inch and coarser	
Turning frame, 14"	
Turning blades, 1/16"x 12", 10 tooth	
Miter-box, 24"x 4" saw, 7" capacity at miter	
Scrapers	
Cabinet	
Glue, triangular	
Veneer, blade 2¾" long, handle 11" long	
Screw Drivers	
Cabinetmakers', 4", 6", and 8" each	
Quick-return, spiral ratchet	
Shoot Board, and plane	
Snips, Tinners', forged steel 2½" cut	
Spokeshaves, adjustable, raised handle, 10" long	
Squares	
Combination, 12"	
Try-, iron handle, 8"	
Framing, 2'	
Steel Figures, hand cut, 1/8", sets	
Tapeline, 50' steel	
Trammel Points, Adjustable metal frame, steel points	
Turning Tools (For 12 lathes)	
Calipers, 6" inside and outside, 12 each	
Calipers, 12" inside and outside, 1 each	
Parting Tools, 1/8"	
Round point, ¼", ½", ¾", each	
Spear point, ¼", ½", ¾", each	
Square point, ¼", ½", ¾", each	
Turning Chisels, ¼", ½", ¾", each	
Turning Gouges, ¼", ½", ¾", each	
Turning Skews, L.H. ¼", ½", ¾", each	
Turning Skews, R.H. ¼", ½", each	
Vise, 3" jaw, anvil face	
Wrenches	
Adjustable, 8", 10", and 12", each	
Headless Setscrew, ¼" to 5/8" by 16ths, 1 each	
Pipe, 10" and 12", each	
S-type or open-end type to fit 1/8" to 1" U.S.S. nuts, each	

(Continued on page 78)

The Columbian Vise & Mfg. Co.

Cleveland, Ohio

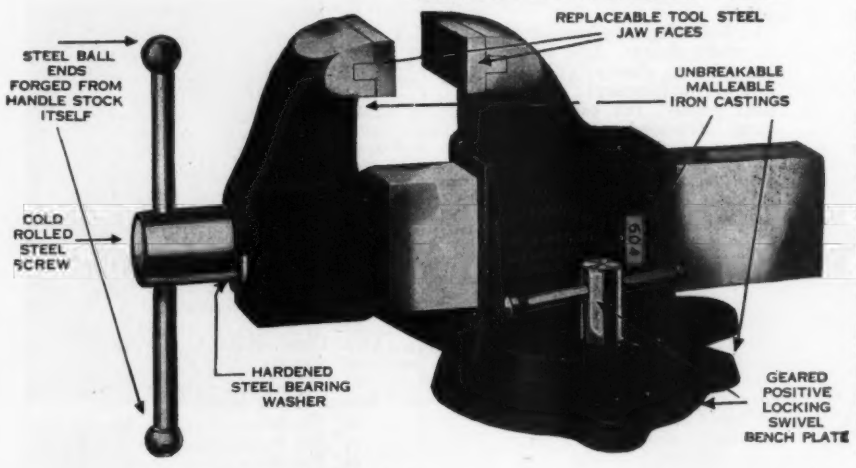
Manufacturers of

COLUMBIAN VISES and CLAMPS

COLUMBIAN VISES AND CLAMPS are standard equipment in schools and in industrial plants — wherever rugged dependability, accuracy and highest quality are demanded in service equipment.

The Columbian Line of Vises is complete and includes every style and size of vise used in metal and woodworking shops. They are sold by hardware and industrial supply distributors. Catalog upon request.

Malleable Iron Machinists' Vises


REPLACEABLE TOOL STEEL JAW FACES
STEEL BALL ENDS FORGED FROM HANDLE STOCK ITSELF
UNBREAKABLE MALLEABLE IRON CASTINGS
COLD ROLLED STEEL SCREW
504
HARDENED STEEL BEARING WASHER
GEARED POSITIVE LOCKING SWIVEL BENCH PLATE

Columbian Machinists' Vises embody the best features of design and construction to insure proper strength, accuracy, and durability.
Castings are made of malleable iron—guaranteed not to chip, crack or break.
Jaw Faces of tool steel dowelled into the jaws but replaceable when worn or damaged; gripping faces are knurled but can be furnished smooth, if desired.
Screws of best grade screw stock, oversize and carefully threaded.
Handles with forged ball-ends which cannot work loose or come off.
Nuts of malleable iron — extra heavy.
Bases are all flat, which makes cutting into bench for installation unnecessary. Swivel type has positive locking mechanism which will not slip.
In addition to the popular styles listed below, vises with swivel back jaw, combination pipe vises and other models can be supplied—all Columbian quality.

Stationary Base Machinists' Vises

Vise No.	503	503½	504	504½	505	505½	506	507	508
Width Jaws	3"	3½"	4"	4½"	5"	5½"	6"	7"	8"
Jaws Open	4½"	5"	6"	7"	8"	9"	10"	12"	13"
Weight, lbs.	20	27	34	44	53	74	90	118	150

Swivel Base Machinists' Vises

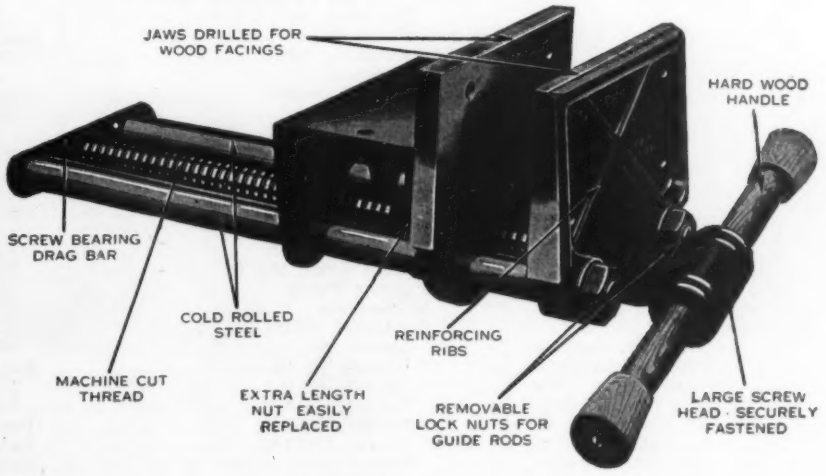
Vise No.	603	603½	604	604½	605	605½	606	607	608
Width Jaws	3"	3½"	4"	4½"	5"	5½"	6"	7"	8"
Jaws Open	4½"	5"	6"	7"	8"	9"	10"	12"	13"
Weight, lbs.	25	32	39	55	61	84	100	135	160

Woodworkers' Vises

Columbian Woodworkers' Vises are made in rapid-acting and continuous-screw styles. Both are simple in construction and efficient in operation.
Castings of heavy grey iron—the best for the purpose.
Jaw Faces are smooth and accurately finished. Have screw holes for installation of wood faces — these can be furnished at slight extra cost.
Screws are extra heavy with carefully cut double threads.
Handles of wood, straight grained and strong. See note below.
Nuts: Bronze half-nuts are used in the rapid-acting models; heavy malleable iron self-centering nuts are used in the continuous-screw models.

Special All-Steel Handles

can be furnished for continuous-screw models at slight extra cost. With this new handle these vises are practically as fast in operation as rapid-acting vises. They will last a lifetime.


JAWS DRILLED FOR WOOD FACINGS
HARD WOOD HANDLE
SCREW BEARING DRAG BAR
COLD ROLLED STEEL
REINFORCING RIBS
MACHINE CUT THREAD
EXTRA LENGTH NUT EASILY REPLACED
REMOVABLE LOCK NUTS FOR GUIDE RODS
LARGE SCREW HEAD SECURELY FASTENED

Continuous-Screw Woodworkers' Vises

Vise No.	5 C	3 C	5 CD*	3 CD*
Size Jaws	4" x 7"	4" x 10"	4" x 7"	4" x 10"
Jaws Open	9"	12"	9"	12"
Weight, lbs.	22	30	23	31

*With dog in front jaw.

Rapid-Acting Woodworkers' Vises

Vise No.	1 R	9 R	1 RD*	9 RD*
Size Jaws	4" x 7"	4" x 10"	4" x 7"	4" x 10"
Jaws Open	9"	12"	9"	12"
Weight, lbs.	24	32	25	33

*With dog in front jaw.

(Continued from page 76)

Woodworking—Materials and Supplies

Name and Description	No.
Alcohol, gallons	
Benzine, gallons	
Brads, pounds	
¾" No. 20	
½" No. 20	
⅝" No. 20	
¾" No. 19	
⅞" No. 19	
1" No. 18	
1¼" No. 16	
1½" No. 16	
1¾" No. 15	
2" No. 14	
2½" No. 14	
Carbon Paper, black, sheets	
Colors, dry, 1-pound cans	
Burnt sienna	
Burnt umber	
Cobalt blue	
Chrome yellow	
Drop black	
Lamp black	
Prussian blue	
Raw umber	
Van Dyke brown	
Vermilion	
Colors, Ground, in oil or japan, 1-pound cans	
Burnt sienna	
Burnt umber	
Cobalt blue	
Chrome yellow	
Drop black	
Drop black, ground in japan	
Lamp black	
Prussian blue	
Raw umber	
Rose lake	
Van Dyke brown	
Vermilion	
Decalcomania Transfers	
Dowels	
¼" hardwood, 3-ft. lengths, feet	
⅜" hardwood, 3-ft. lengths, feet	
⅜" hardwood, 3-ft. lengths, feet	
½" hardwood, 3-ft. lengths, feet	
¾" hardwood, 3-ft. lengths, feet	
Dowel Pins and Plates	
Enamel	
White, 1-pt. cans	
Undercoater, 1-pt. cans	
Fillers, Paste, pounds	
Natural	
Golden Oak	
Dark Oak	
Mahogany	
Fillets, leather, ¼" and ½"	
Glue, hide, best grade cabinet, pounds	
Liquid, 1-qt. cans	
Hardware	
Such as brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports.	

Name and Description	No.
Hooks	
And Eyes	
Cup	
Screw	
Square Screw	
Lacquer, in 1-pt. cans	
Black	
Clear	
Cobalt blue	
Ivory	
Medium green	
Red	
Thinner	
White	
Yellow	
Lumber	
The following woods are used in school shops: Ash; balsa; bass; birch; cherry; cypress; locust; mahogany; maple; oak; poplar; red cedar; red gum; redwood; sap gum; yellow pine; walnut; white pine.	
In ordering pine, mill-run, kiln-dried will be found suitable for carpentry, while short select, kiln-dried 4" and wider, or No. 1 shop common, kiln-dried will be required for cabinetmaking and pattern-making.	
Hard wood, for furniture, should be specified first and second grade, kiln-dried, standard widths and lengths, or short lengths.	
Moldings	
Nails, pounds	
Common, 6d	
Common, 8d	
Common, 10d	
Flat Head	
½" No. 20	
¾" No. 19	
1" No. 18	
1¼" No. 16	
1½" No. 16	
2" No. 14	
Finishing, 4d	
Finishing, 6d	
Finishing, 8d	
Oil, gallons	
Linseed, boiled	
Linseed, raw	
Machine	
Rubbing	
Overlay Carvings	
Panel or Plywood	
3 ply, 5 ply, 7 ply	
Pattern Letters	
Pins, Escutcheon	
Pumice Stone, No. 0	
Rapping Plates	
Rottenstone	
Sandpaper, reams	
Garnet, No. 1	
Garnet, No. ½	
Garnet, No. 0	
Garnet, No. 2/0	
Garnet, No. 3/0	
Garnet, No. 4/0	
Garnet, No. 6/0, wet or dry finishing	
Garnet paper can also be obtained in rolls of 50 yd. each, and in widths 3" and up.	
Screw Eyes	
Screw Hooks	

Name and Description	No.
Screws, gross	
Flat-Head, brass	
¼" No. 3	
½" No. 4	
⅝" No. 5	
¾" No. 5	
¾" No. 6	
1" No. 8	
1¼" No. 10	
1¼" No. 12	
1½" No. 10	
1¾" No. 12	
2" No. 10	
Flat-Head, bright	
½" No. 3	
½" No. 4	
¾" No. 6	
1" No. 8	
1" No. 10	
1¼" No. 10	
1¼" No. 8	
1¼" No. 14	
1½" No. 10	
1½" No. 12	
1¾" No. 10	
1¾" No. 12	
2" No. 10	
2" No. 12	
2" No. 14	
2¼" No. 12	
2¼" No. 14	
2½" No. 14	
Oval-Head, brass	
¾" No. 5	
1¼" No. 10	
Round-Head, blued	
⅜" No. 3	
½" No. 3	
¾" No. 5	
¾" No. 6	
1" No. 8	
1¼" No. 10	
1½" No. 10	
1½" No. 12	
Round-Head, brass	
⅜" No. 2	
⅜" No. 3	
½" No. 4	
⅝" No. 3	
¾" No. 5	
Shellac	
Orange, cut 4 pounds to the gallon, ½-gal. cans	
Sticks, assorted colors	
White, cut 4 pounds to the gallon, ½-gal. cans	
Note: Shellac should be kept in glass or earthenware containers.	
Stains, Oil, spirit or water, quarts.	
Fumed Oak	
Dark Oak	
Golden Oak	
Light Oak	
Mahogany	
Walnut	
Steel Wool, 1-lb. packages	
No. 0	
No. 00	
Turpentine, gallons	
Twine, balls	
Varnish, ½-gal. cans	
Flat	
Remover	
Rubbing	
Waste, pounds	
Cotton, white	
Wax, pounds	
Bees	
Finishing	
White Lead, pounds	

Porter-Cable-Hutchinson Corporation

1919 Park Street, Syracuse, N. Y., U. S. A.

Representatives in principal cities

Manufacturers of

Portable Woodworking and Sanding Machinery

TAKE-ABOUT Sander

Twenty-six years in the manufacture of machine tools (parts of which are held to half a thousandth of an inch) qualifies us to build sanders and woodworking machinery that give their owners a long period of accurate and practical service. Primarily industrial machines, they are ideally suited for practical shop instruction. Should your students select an industrial career, they will find our machines in many shops, for PORTER-CABLE Sanders are the most widely used in the world. This should be a determining factor in your decision to specify them for your shop work—and it's surprising how well they fit in your budget.

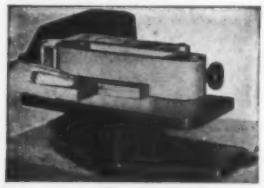
PORTER-CABLE SANDERS

Take-About Sanders

The TAKE-ABOUT Sander speeds up instruction in the shop and makes the work more interesting for the student by eliminating much uninstructive, tedious handsanding. DUSTLESS TAKE-ABOUT Sander, Type B-10, is illustrated. Vacuum system picks up harmful dust. So perfectly balanced your smallest student can handle it with ease. Smooth abrasive belt action secures a beautiful finish. When not used in the shop, the TAKE-ABOUT will pay for itself refinishing desks, seats, tables, blackboards, etc. Thousands of schools have adopted the TAKE-ABOUT as standard equipment. Made in four sizes. Ask for demonstration or further details—no obligation.

Does Work of Disc, Belt and Spindle Sanders

Take-About Bench Stand



With a Bench Stand you double the utility of a TAKE-ABOUT. Converts it into a small stationary belt sander for surfacing small pieces or grinding tools. Front pulley can be used as a spindle sander. The Bench Stand is a valuable, inexpensive accessory to the TAKE-ABOUT. Include one in your order.

Only Shop Machine That Pays For Itself

—and therefore justifies its inclusion in every budget even if no other equipment is purchased.

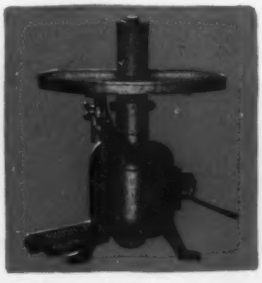
Why pay for refinishing desks, blackboards? Pays for itself first season. Eliminates hand planing and scraping. Sands curves and seat backs. Five times faster than hand work. No need to dismantle desks. Valuable on stairs, edges of floors, boats, furniture. Let us show you what this machine can do on a wide variety of work.

Four Styles to Choose From

Dustless Take-About Sander shown above most desirable for school use because of vacuum system. Notice perfect balance, insulated rubber covered pulleys, polished finish. Every little detail has been painstakingly perfected to provide convenient operation, long life and safety. Three other types from 14 to 24 lbs. Fully guaranteed.

Bench and Pedestal Spindle Sanders

Now you can have an Oscillating Spindle Sander that will not strain your budget, yet one that will easily meet all your requirements, finishing curves and irregular work. The table tilts 45 degrees, securing accurate drafts and angles. Pedestal machine has casters and can be moved to any part of the shop and run off the light circuit. Uses rolls from 1" to 4" diameter.



Belt Sanders—3 Types

This Belt Sander is rapidly gaining favor among school instructors because of the large variety of surfacing work it can handle. Long or short pieces, sanding down joints, making core prints, are all within its scope. Due to smooth, even belt action a beautiful straight grain finish is secured. Vacuum dust removal system makes it an ideal machine for shop use. Has two speeds. Can be changed from horizontal position (as illustrated) to vertical position in few seconds. Perfectly safe and an excellent sander for all around shop use.

Syracuse Disc Sander-Grinders—3 Types

This machine, the pioneer of all dustless motor-driven Disc Sanders, has proved by its years of universal service that it is the standard for performance and dependability. Designed for the accurate sanding of segments, angles for built-up work, core prints and circular taper work. By use of the angle gauge, graduated in degrees, together with the adjustment for tilting the table by degrees, absolute accuracy is secured. Runs off light circuit. Ideal for instruction purposes.

Band Saws, 14", 16", and 20"

Accuracy and safety are the keynotes of this twenty-inch Band Saw. Quiet and vibrationless. Has a capacity for handling hard or soft wood up to 9" thick. Round metal table or square wood table optional. Can be arranged to run at any of these speeds—300, 500, 600, 750, 1000, 1575, 3150 linear feet per minute. Also 14" and 16" can be supplied for either floor or bench use.

Porter-Cable-Hutchinson Corporation, 1919 Park Street, Syracuse, N. Y.

The New Britain Machine Co.

New Britain, Connecticut

Manufacturers of

Industrial Arts, Vocational and Trade School Equipment

The New Britain Industrial Arts, Vocational, and Trade School Equipment Line embraces many items which have been *specially designed* for use in departments devoted to the teaching of various arts and trades, such as Woodworking, Machine Shop practice, Electrical Trades, Auto Repairs, Art, Drafting, Foundry, Welding, Forging, Plumbing, Printing and the like, as well as the Physics, Science and Chemical Laboratories.

"New Britain" Equipment is installed in many State Trade Schools, and in many of the newest and largest Vocational High Schools.

Patent No. 1887399
and Patent Pending

DRAWING TABLE No. 9660

28" x 36" x 38" high with steel bench legs, steel panels, steel stringer at rear, under top, steel cross bar and foot rest, hard or soft wood top inclined at 7°, four individual steel drawers 8" x 23" x 3", each with cylinder lock and keys master keyed; and steel board cabinet holding four boards, from 18" x 24" to 23" x 31", with steel door and padlock attachment, if desired.

Patent No. 1887399
and Patent Pending

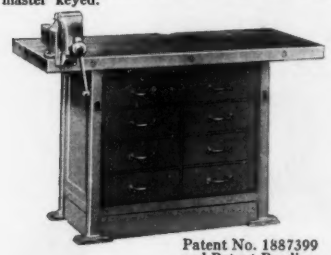
MANUAL TRAINING BENCH No. 94212

Four student type, 54" x 45" with 2¼" maple top, steel supporting frame, with steel side, back and dust panels, completely enclosed to floor, four continuous screw vises, four dogs, two stops, two steel drawers, 30" x 15" x 5", twelve steel drawers 14" x 15" x 5", each drawer with cylinder lock and keys, master keyed.

Patent No. 1887399
and Patent Pending

MANUAL TRAINING BENCH No. 91008

Single student type 52" x 22" with 2¼" maple top, steel supporting frame, with steel side, back and dust panels, completely enclosed to floor, one continuous screw vise, one dog, one stop, and eight steel drawers 14" x 15" x 5", each drawer with cylinder lock and keys, master keyed.



Patent No. 1887399
and Patent Pending

MACHINIST'S WORK BENCH No. 95106

30" x 60" x 32" high with 1¾" or 2¼" maple top, steel supporting frame, with steel side, back, and dust panels, completely enclosed to floor, one steel drawer 30" x 15" x 5", and six steel drawers 14" x 15" x 5", each drawer with cylinder lock and keys master keyed.

Patent No. 1887399
and Patent Pending

DRAWING TABLE No. 9656

28" x 36" x 38" high with steel bench legs, steel stringer at rear, under top, steel cross bar and foot rest, hard or soft wood adjustable top, steel general drawer 20" x 20" x 3½", with cylinder lock and keys, master keyed, and steel cabinet holding six boards, from 18" x 24" to 23" x 31", with steel door and padlock attachment, if desired.

Patent No. 1887399
and Patent Pending

DRAWING TABLE No. 9655

28" x 36" x 38" high with steel bench legs, steel panels, steel stringer at rear, under top, steel cross bar and foot rest, hard or soft wood adjustable top, six individual steel drawers 8" x 23" x 3" each with cylinder lock and keys, master keyed; and steel cabinet holding six boards, from 18" x 24" to 23" x 31", at rear, with steel door and padlock attachment, if desired.

Patent No. 1887399
and Patent Pending

DRAWING TABLE No. 9654

28" x 36" x 38" high with steel bench legs, steel stringer at rear under top, steel cross bar and foot rest, hard or soft wood top, inclined at 7°, no drawers, no board cabinets.

EVERLASTING.
SANITARY.
STEEL CONSTRUCTION.

100 DRAWING AND ART TABLE DESIGNS ARE AVAILABLE.

55 MANUAL TRAINING AND MACHINIST'S WORK BENCH DESIGNS ARE AVAILABLE.

WRITE FOR COMPLETE CATALOG No. 707SE CONTAINING FULL DETAILS.

The New Britain Machine Co., New Britain, Connecticut

The New Britain Machine Co., Continued

New Britain Benches may be adapted to a host of uses, to suit varying conditions. Benches may be furnished, electrically plated by Udylyte process for use in glue and stain work, or, covered with 1/16" sheet lead for battery repair work, or with specially treated carbonized maple tops for science, physics and chemical laboratory work, etc.

We solicit inquiries from school authorities on special problems, in equipping schools. Our engineering force is ready at all times to assist in any way toward solving equipment problems, whether of a standard, or of a special nature.

Patents Nos. 1797717 and 1887399

SMOOTH TOP STEEL BENCH No. 909
24" wide x 6' long x 32" high

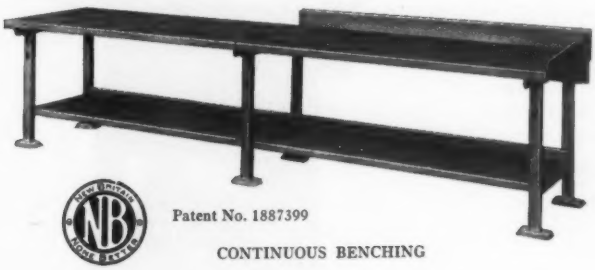
Patent No. 1887399

LAMINATED MAPLE TOP BENCH No. 944
24" wide x 6' long x 32" high

Patents Nos. 1797717 and 1887399

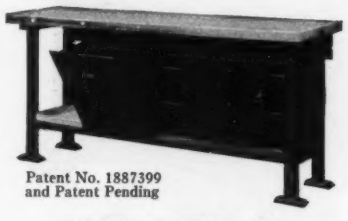
COMBINATION TOP BENCH No. 963
24" wide x 6' long x 32" high

MORE THAN 700 DIFFERENT BENCH DESIGNS AND SIZES ARE AVAILABLE FROM THE NEW BRITAIN LINE.



Patent No. 1887399

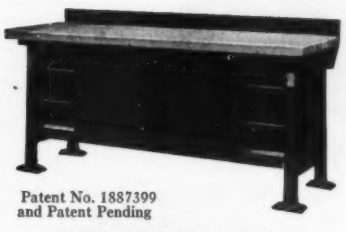
CONTINUOUS BENCHING



Patent No. 1887399 and Patent Pending

CABINET BENCH No. 9524
24" wide x 6' long x 32" high
Standard Lengths—6', 9', 12'
Standard Width—24"
Standard Height—32"

TOPS—Steel, Maple, or Combination Steel and Maple may be had for all sizes.



Patent No. 1887399 and Patent Pending

CABINET BENCH No. 9502
24" wide x 6' long x 32" high
Standard Lengths—3', 4'6", 6', 9', 12'
Standard Widths—24", 30", 36", 42", 48"
Standard Height—32"

TOPS—Steel, Maple, or Combination Steel and Maple may be had for all sizes.

STEEL — MAPLE — COMBINATION TOP — AND CABINET BENCHES MAY BE SET UP AS CONTINUOUS BENCHING OF ANY GIVEN LENGTH.

Patent No. 1887399 and Patent Pending

STAKE BENCH No. 9600
30" wide x 6' long x 32" high
Standard Lengths—6', 9', 12'
Standard Widths—30", 36", 42"
Standard Height—32"

Maple Top 2¼" thick, New Britain Stake Plate, angle iron edge, rabbetted flush with top and edge; Type O Tubular Steel Sanitary Bench Legs, and steel shelves, edges turned up.

STEEL—
FOR SAFETY—
DURABILITY—
AND
ECONOMY.

Patents Nos. 1797717 and 1887399

WELDING BENCH No. 985
36½" x 36½" x 33⅝" overall, complete with top, legs, drawer, compartments and fire brick.

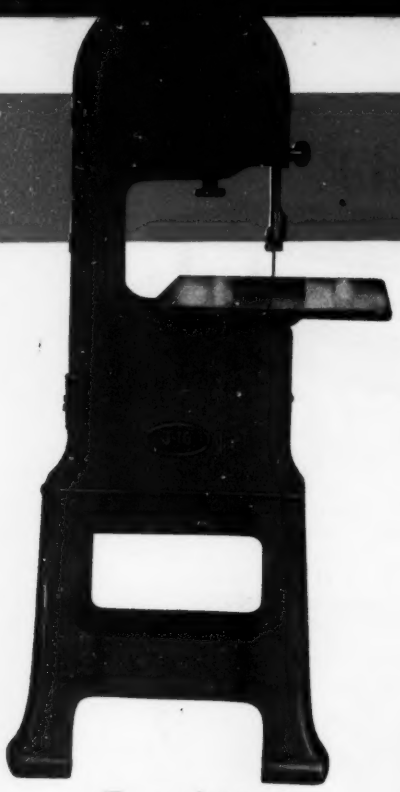
WRITE FOR COMPLETE CATALOG No. 707SE CONTAINING FULL DETAILS.

The New Britain Machine Co., New Britain, Conn.

YATES

SHOWN here is our complete new line of school machines —machines built with the same careful workmanship and possessing the same advanced design as machines used in industry, machines that are typical of the progress made in woodworking machinery which has resulted from the demand for speed, safety and reliability.

As you raise your eyes to the top of the next page you are confronted by a name that for many years has stood at the head of the list of manufacturers catering to the requirements of the schools. The American Woodworking Machinery Company—one of our predecessors—was the leader in the contribution of well designed machines for school use, and also furnished many educational aids to vocational training. It was natural, therefore, that it should be Yates-American —keeper of this heritage—the manufacturer to undertake



Type J-16

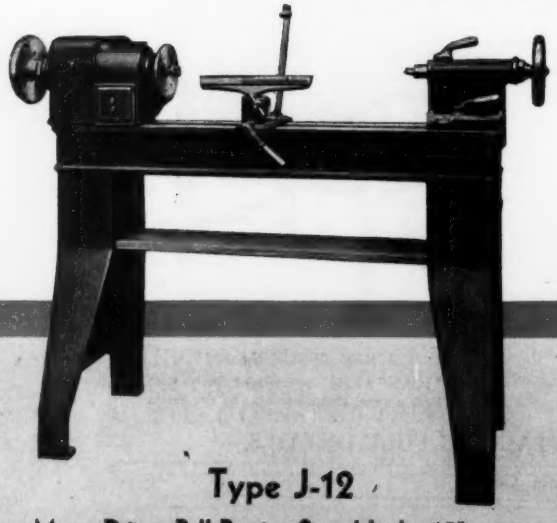
Direct Motor Driven Ball Bearing Scroll Band Saw. 16" wheels. Totally enclosed. Well balanced to avoid vibration.

Type J-20

Direct Motor Driven Ball Bearing Tilting Arbor Saw; cuts 2½" thick. Same adjustments as on large industrial machines.

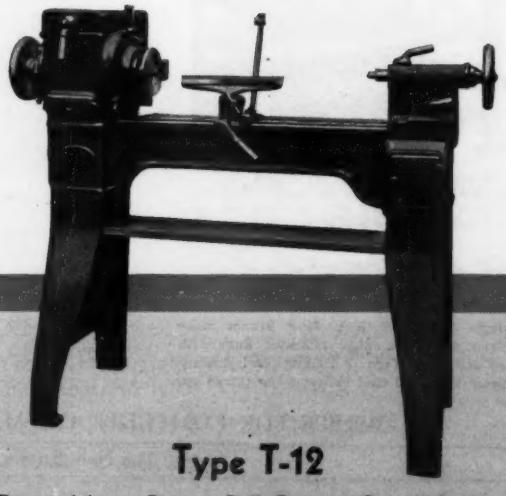
Type J-18

Direct Motor Driven Ball Bearing Single Surfacer, 18" wide. The only surfacer built to meet the requirements of school use.



Type J-12

Motor Driven Ball Bearing Speed Lathe 12" swing, 24" to 72" centers, four speeds 750, 1200, 1500, 2400 r.p.m. Has universally adjustable front clamp lever for tool holder.



Type T-12

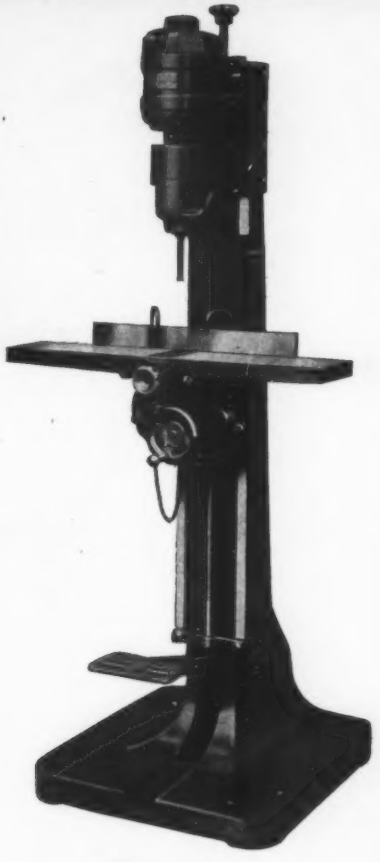
Direct Motor Driven Ball Bearing Speed Lathe, 12" swing, 26" to 74" centers, spindle brake, spindle lock, safety control, universally adjustable clamp lever, four speeds 600-1200-1800-3600 r.p.m..

AMERICAN

the task of producing a group of machines to meet the present requirements of manual and vocational training.

Recognizing the desirability of instructing students on machines of uniform size and capacity, we designed these machines as a correlated group and built them to the same high standard of efficiency, ease of operation and reliability as our larger machines. These machines are in every respect small counterparts of the large industrial machines, except that all their operating features have been simplified and the safety features intensified.

As Yates-American machines predominate in the woodworking industry, the teaching of woodworking on these Yates-American school machines gives to the teacher the confidence that is born of doing a thing right, of using the proper tools to do it with, and is to the student an added assurance of success in his industrial career.



Type J-40

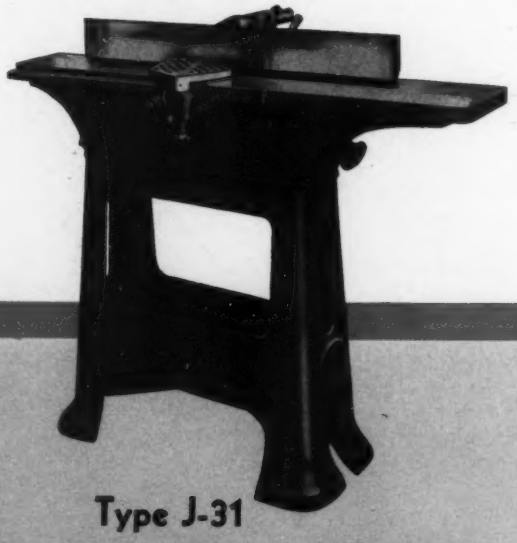
Direct Motor Driven Ball Bearing Hollow Chisel Mortiser and Borer, plain or compound table, ½" chisel capacity.

Type J-50

Motor Driven Ball Bearing High Speed Single Spindle Shaper. Furnished with suitable safety guard.

Type J-45

Direct Motor Driven Ball Bearing Oscillating Spindle Sander with tilting table, adjustable for height.



Type J-31

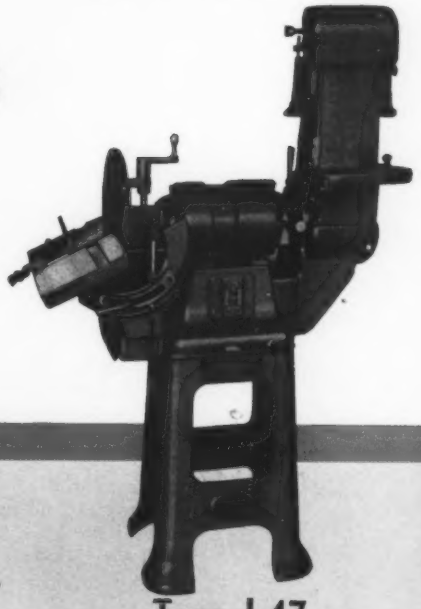
Direct Motor Driven Ball Bearing Hand Jointer. 6" and 8" widths, 42" tables, with tilting fence and safety guard.

Write for illustrated circular and complete details to

YATES-AMERICAN MACHINE COMPANY

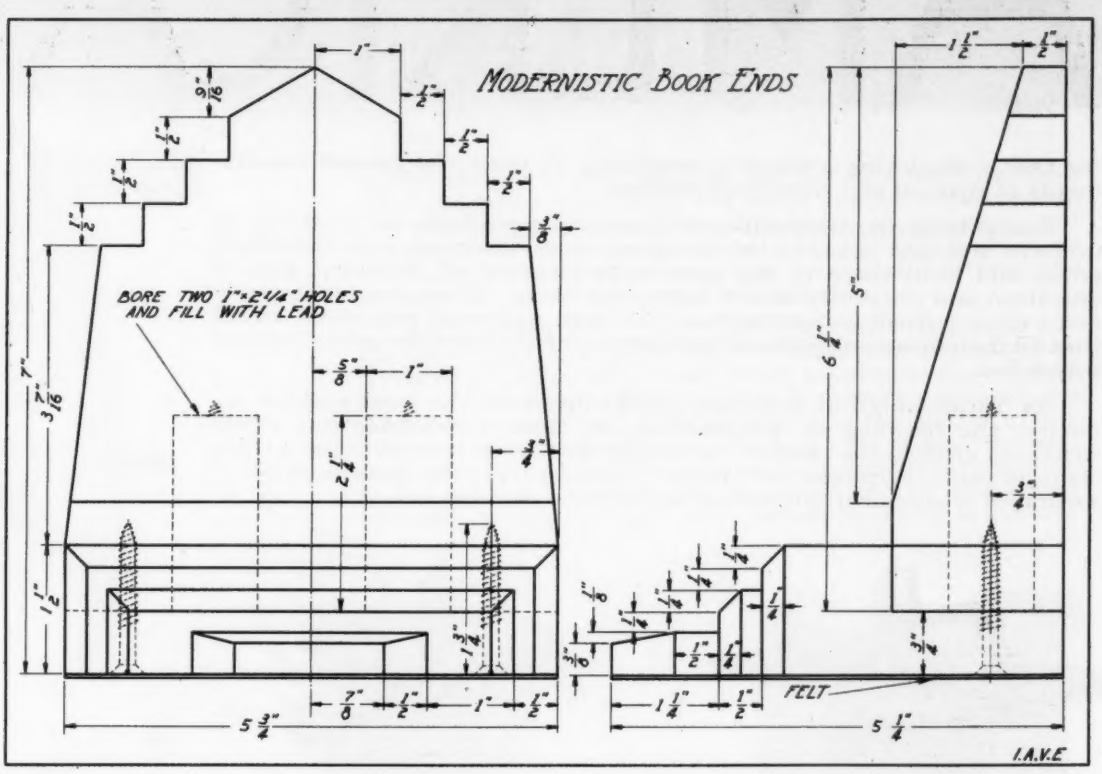
Vocational Division

Beloit, Wisconsin



Type J-47

Direct Motor Driven Ball Bearing Disk and Belt Sander with adjustable tilting table. Furnished also with disk and drum or with two disks.



(Continued from page 70)

in design. Simple as this project is, it presents excellent opportunities for learning the basic tool operations.

It also may be used by the high-school student by adding inlay work if that seems desirable.

CIRCULAR SAWS, THEIR CHARACTERISTICS AND USE—IV

John E. Doren, Supervisor of Industrial Education, Eureka, California

(Continued from December, 1932)

The Circular Rough Crosscut Saw

A. The *rough crosscut saw* is designed:
   1. For fast cutting where great accuracy and smoothness of cut are not as essential as speed.
   2. For crosscutting only. The saw should never be used for ripping, but may be used:
      a) For crosscutting rough lumber.
      b) For crosscutting wet lumber.
      c) For crosscutting poorly seasoned lumber (casehardened lumber, hollow-horned lumber, honeycombed lumber)
      d) For crosscutting crooked lumber when stock is safely supported on the table, and against the guide of the machine.
      e) For crosscutting warped (twisted) lumber when the material is safely supported.

Note: The term "crosscutting" should not be confused with the term "trimming." When trimming a piece of lumber, it is rare that more than ½ in. of material is trimmed off, and the trimming is usually done with a smooth-cutting saw. "Crosscutting" is the correct term for the rough crosscutting of lumber at any point in its length.

B. Characteristics of the rough crosscut saw:
   1. The blade is of uniform gauge, or thickness, throughout.
   2. The teeth are:
      a) All alike in profile all around the saw.
      b) Heavily spring-set for clearance.
      c) Filed with pronounced bevel on the fronts as illustrated in Figure 8.
      d) The fronts of the teeth are either normal or slightly raking, with one unit of rake to approximately four units of height. (See Figs. 9 and 10.) The fronts are filed with a pronounced bevel.
      e) The backs of the teeth are:
         (1) filed square across or with a *slight bevel* to form strong points. Teeth thus shaped are suitable for cutting hard and dirty lumber and serve well for crosscutting in general, or they may be
         (2) filed with *pronounced bevel* to form keen, knife-like points. Teeth thus shaped are suitable only for cutting clean lumber; vis., soft wood of any thickness and thin pieces of hard wood.

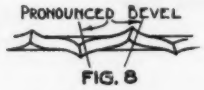


FIG. 8

NORMAL TEETH. FRONTS ARE RADIAL TO CENTER OF SAW. THESE TEETH ARE SUITABLE FOR CUTTING SOFT AND WET LUMBER

FIG. 9

RAKING TEETH. FRONTS INCLINE BACKWARD FROM RADIAL LINE. THESE TEETH ARE SUITABLE FOR CUTTING HARD OR DRY LUMBER, THEY WILL SPLINTER THE STOCK LESS THAN NORMAL TEETH.

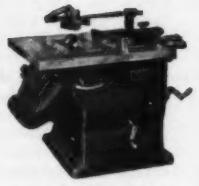
FIG. 10

C. Operation of rough crosscut saw:
   1. Saws with large teeth (2 or 3 points per inch) are well adapted to cutting thick material—lumber 2 in. thick or thicker.
   2. Saws with relatively small teeth (4 to 6 points per inch) are well adapted to cutting thin lumber, 1 in. thick and under, but may be used for cutting lumber up to 2 in. thick if cutting is not hurried or forced.

(Continued on page 88)

"OLIVER" WOODWORKING MACHINERY

The acceptance of the "Oliver" line by schoolmen is based upon satisfactory results from "Oliver" equipment in use in school shops thruout the country

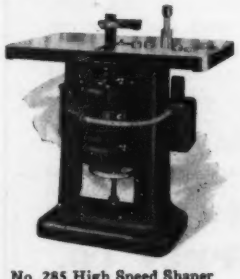


No. 290 Double Arbor, Motor Arbor, Tilting Saw Bench

No. 144 6-inch Hand Planer and Jointer

No. 91 Hollow Chisel Mortiser

No. 182 Disk Sander



No. 285 High Speed Shaper Operates without frequency changer

The illustrations herewith present only a few of the many "Oliver" Machines that have a school shop application. Descriptive circulars of any or each machine are available upon request.

All "Oliver" Machines are built to meet the exacting requirements of industry and the school shop. Irrespective of size or price all "Oliver" Machines are built to the same high standard of quality. There are no differences in workmanship or material.

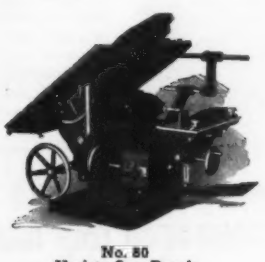
An Invitation to School Shop Executives and Architects

The Oliver Machinery Company in its many years of service to the school shop has had considerable experience in the planning and layout of the school wood shop. We have aided in the completion of hundreds of plans and accordingly invite school shop executives and architects to call upon us for service and advice in making plans, writing specifications, and in suggesting "layouts" for schools.

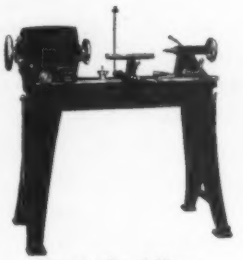
Complete information on any or all machines gladly sent on request. No obligations.

Oliver Machinery Company
Grand Rapids, Michigan, U.S.A.

No. 173 Self-contained Jig Saw

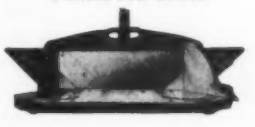


No. 80 Variety Saw Bench

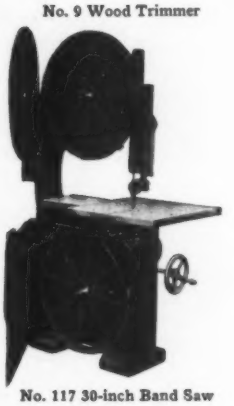


No. 51 4-Speed Motor Head Lathe

No. 585 Oilstone Tool Grinder



No. 9 Wood Trimmer



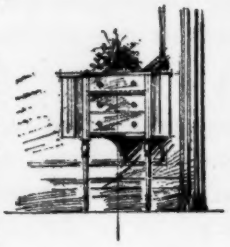
No. 117 30-inch Band Saw

No. 199 24-in. Single Surface Planer

KLISE

WOODCARVINGS—MOULDINGS ORNAMENTATION

THE ordinary every-day project of the vocational shop may be lifted out of the ordinary by treating it as the finer pieces of furniture are treated in the shops of the best furniture makers. It can be made an achievement in fine cabinet making through the application of carved wood mouldings.



After careful coöperation with educational leaders and with some of the greatest furniture designers, Klise Manufacturing Company makes available to the Vocational Shops the materials with which to build these more beautiful pieces.

"BOOK OF PROJECTS"

The "Book of Projects" introduces to you not only many fine new projects, but also carved wood mouldings, ropes, beads, rosettes, etc., and shows you the application of these carvings in the enrichment of your projects. A charge of 50 cents per copy is made for the book. Complimentary copies to supervisors only.

Klise Products

A few typical examples of mouldings and ornamentation are illustrated below. There are many other designs available at exceedingly reasonable prices, and we will welcome correspondence in regard to the carved wood decorations of projects.

G-51—Sizes ⅜" and ½" Dia.

D-774 — ¾" x ⅜"

R-810—¾", 1", 1¼", 1½". Gum—Wal.—Mhgy.

Plain turned rosettes are available in a variety of design, size and wood.

R-840—1½" Dia.

Many patterns of carved rosettes in unusual designs are supplied in a good range of size and wood.

A-6 ½" Dia.

ROPE MOULDINGS

Rope mouldings are a popular type of ornament. A carefully selected group of patterns are offered for your selection. Ropes together with beads are stocked in several woods, numerous sizes and in full round and half round shapes.

Small Sample Assortment Upon Request

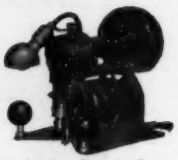
KLISE MANUFACTURING CO., Inc.
Grand Rapids Michigan

OCCUPATIONAL TRAINING

- SAFE
- SIMPLE
- PRACTICAL
- INEXPENSIVE

The Cutawl quickly arouses student interest and creates desire for accomplishment. With this practical and inexpensive machine, the pupil may cut out unique and interesting designs, such as letters, signs, stage sets, decorations, puzzles, stencils, toys, furniture—useful projects that train young minds and hands for profitable future occupations.

The Cutawl



A modern, portable electric cutting tool. Weight, only 13 pounds. Cuts any design wanted in any material, ranging from thin paper to steel sheets. Easy to operate and safe to handle. Used extensively for industrial display cutting.

FREE TRIAL—NO RISK!

Test its usefulness in your shop or class room, without obligation or expense. Write for full details at once.

INTERNATIONAL REGISTER COMPANY
29 S. THROOP STREET CHICAGO, ILLINOIS

What a Bargain

$8.50 $8.50

Due to present business conditions we find ourselves overstocked on our No. 100 K. D. walnut chests. Regardless of price, these must be moved immediately. Our loss is your gain. While present supply lasts the price will be $8.50 each, net cash. Never again will you be able to duplicate this value.

SPECIFICATIONS

A Big Chest—size 45 in. long, 19 in. high, 19½ in. deep. Solid walnut front, top, ends and legs, cedar bottom and back. Cedar panels, approximately ¼ in. thick, furnished to be tacked on inside ends and inside of cover. Birdseye maple panel for front of chest. Spiral carvings are pressed wood. Corners are machined with lock joint. Bottom is paneled to fit into grooves in the ends, front and back. Moulding for top is loose and not mitered. Panel and carvings are not attached. No hardware included. Carefully papered and crated—weight 80 lbs. Shipped promptly from Anoka. Be sure to specify whether express or freight shipment is desired.

Note—This chest is illustrated and described in our Eighteenth Annual Catalog of "Hard-to-Get" Materials, sent promptly on request to all Manual Training Instructors.

THURSTON SUPPLY CO.
Anoka, Minnesota

A New Era in Motor-Driven Woodworking Tools for Schools

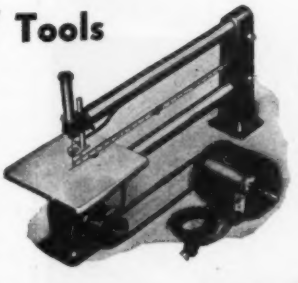
Delta now offers to Vocational Education the "Multi-Unit" Plan for Woodworking Shops. Under this plan a larger number of compact but efficient motor-driven tools is available for class work. These smaller units are built of enduring materials to fine precision limits and are designed to combine maximum convenience and effectiveness with long years of satisfactory service. Delta "Quality Tools" have passed gruelling production tests in factories all over the country. They are most practical for school use—because they are the type of tools most likely to be used by student after graduation. Best of all, they are priced so low as to permit a larger number of tools per student—and yet come comfortably within 1933 budgets.

New "Delta" Lathe

This unusual machine incorporates numerous new ideas in construction and design that give it extraordinary strength and rigidity, plus the accuracy and convenience ordinarily found only in lathes selling for many times its price. This is no toy lathe, but a sturdy unit capable of handling precision production work, and priced astonishingly low. See "Delta's" 1933 Catalog for full details.

A Complete Line of "Quality" Tools

"Delta" Woodworking Units are convenient, portable and compact. All are available in a large variety of combinations and at prices to fit all needs. The "Delta" line includes Jointers, Circular Saws, Band Saws, Wood-turning Lathes, Drill Presses, Scroll Saws, Boring, Routing, Sanding and Mortising Attachments, and a complete line of accessories.



New *Delta* DRILL PRESS

It would take almost a book to completely describe the features, advantages and range of operations of this sensational new addition to the Delta line. Briefly, the new "Delta" Drill Press measuring 68 inches high and provided with a heavy floor base, is a precision tool — built to meet the most exacting demands of production work and yet priced unbelievably low. It incorporates numerous new features . . . including Ball Bearing Spindle, Accurate Chuck, Tilting Table, Enormous Capacity, and many more. It is really two machines in one —as the head can be reversed and used efficiently as a Shaper.

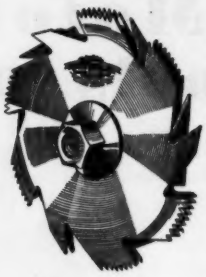
Hollow Chisel Mortising Attachments are available. For full details see the new "Delta" 1933 Catalog.

Catalog Free!

Every man who works with wood will want to see this FREE 1933 "Delta" Catalog of Quality Woodworking Tools. It shows the full line of the latest "Delta" Tools. It is packed with interesting illustrations and descriptions. It describes the latest developments in motor-driven equipment at the astonishingly low 1933 price levels. Be sure to get YOUR copy. Write today.

DELTA MFG., CO., 3775 N. Holton St.
Dept. E233, Milwaukee, Wisconsin

Delta Tools Aroused Great Interest at the A. V. A. Convention in Kansas City



SIMONDS DADO SAWS

By combining outside saws with inside cutters, clean grooves may be cut in any direction of the wood any width from ⅛ to 4 inches wide. When writing state widest groove to be cut.

The Smooth Cutting
PLANER SAW

Cuts with or across the wood grain and leaves an edge smooth enough for glue joints. Saves time.

LIST PRICES (subject to discount)

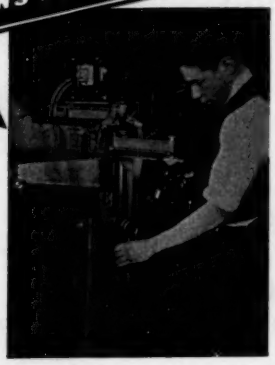
6 inch $5.55	12 inch $11.20
8 inch 7.00	14 inch 13.40
10 inch 9.00	16 inch 15.80

Brown steel
BAND SAWS
any width or length

Write for Saw catalog

SIMONDS SAW AND STEEL CO.
Fitchburg, Mass.

This Is the Practical Way To Keep Your Saws Filed Perfectly



SAVES
Time - Money - Saws!

Many woodworking instructors have definitely ended all saw-filing problems and labor by using the Foley Automatic Saw Filer. Their students are being taught to operate the Foley, which does the work automatically.

FOLEY AUTOMATIC SAW FILER

Senior High School, Everett, Mass. "The Foley Automatic Saw Filer does perfect work and is operated by boys in my classes. We have real sharp, clean-cutting saws now."
Charles W. Hurn.

One Machine Files All Saws
—hand saws, band saws and cross-cut circular saws. Every tooth is automatically filed and jointed to exactly the same size and spacing. No eye strain. Makes saws cut cleaner, faster, truer and stay sharp longer. Used in hundreds of schools and woodworking plants throughout America. Every student should know how to operate a FOLEY. *Write us today for complete information.*

Yes! Send Your New Booklet

FOLEY MANUFACTURING COMPANY
18 Main St. N. E. Minneapolis, Minn.

(Continued from page 84)

Note: Large teeth have large gullets between them in which the dust is chambered as it is made and carried out of the cut. Small gullets will fill and choke up before the teeth can pass through thick material and carry out the dust that has been made. As soon as a small gullet becomes filled with dust, the teeth adjacent are no longer capable of cutting into the stock until the dust in the gullets is shaken out, which can only happen after the teeth have passed out of the cut. Fast cutting of thick lumber is possible only with saws having large teeth and large, deep gullets.

3. Safety:
   The saw blade should be so adjusted that it will cut through the material and project above the work not more than ¼ of an inch. It is also essential that the material shall be safely supported while being cut, to prevent any sudden or unexpected movement that might injure the worker or ruin the work.
4. Allowances:
   Lumber cut with rough crosscut saws must often be trimmed to a finished length later, and due allowance must be made for this at the time of the rough cutting. It is common practice in many mills to roughly cut all stock 1 in. over length to permit of trimming both ends later to final dimensions.

Questions for Thought and Discussion

1. What is the chief purpose for which the rough crosscut saw is designed?
2. What is the difference between "trimming" a piece of lumber and "crosscutting" a piece of lumber?
3. Why is a rough crosscut saw, when properly sharpened, well adapted to the cutting of rough, wet, crooked, or poorly seasoned lumber?
4. Why are the fronts of the crosscut teeth filed with a pronounced bevel?
5. Why are crosscut saws with very small teeth poorly adapted to the cutting of thick lumber?

STUDENT PROGRESS AND GRAPH CARDS

Chester A. Lyle, McKinley High School, Canton, Ohio

The time required for grading approximately 120 printshop pupils each day at McKinley High School averages about five minutes per section. There are four sections of eighty minutes each. This is accomplished by using the progress card shown herewith.

The card, as shown, contains spaces for thirty days. This represents a six-week period on which a report to the parents is based.

Each shop period is divided into eight 10-minute units and these units are noted under the description column along with the different lessons of work done.

The date and time commenced, and time finished column is not inserted with the sole idea of keeping track of a student's speed, but rather that he may have an accurate valuation of his own ability at all times. The grade card is used by the student every day and he enters his grade upon it each day. Knowing his grades at all times tends to develop in the student a greater interest in his work, and increased carefulness in doing each job.

"Citizenship items are valued for the part they play in the student's life at school as well as for the training they are to give him for the future."

By following closely the units marked in the description column, one may keep track of a student's work continuously, and by filing the cards to have his complete record for the school year. In addition, it is possible to ascertain just what he did on any day during the school year.

Each student must add his total points weekly so that the summarizing at the end of the six-week period takes but a

(Continued on page 90)

Walker-Turner Company

Plainfield, New Jersey

Manufacturers of

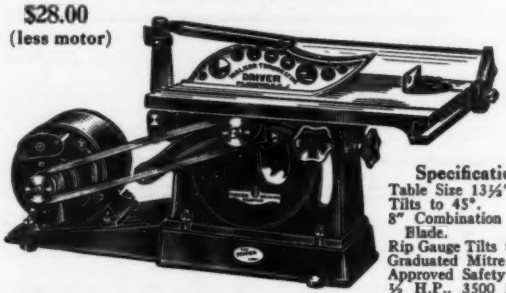
DRIVER Power Tools

The 1933 "Driver" Line might well be called the "Thrift" Line: In step with the times, it is notably economical both in initial cost and in operating expense. The latest reductions in the cost of iron, steel, and other materials are clearly reflected in the new heavier and greatly improved "Driver" Tools. Today, features are included which were out of the question a year or two ago. Now you can have real production tools for your school shop at a price so low that you would actually lose money to be without them. Write for our complete, beautifully illustrated catalog on "DRIVER" Power Tools.

By closely examining the specifications of "Driver" Power Tools, you will notice that they meet the best standards of quality tools. "Driver" engineers have incorporated new practical devices wherever machine efficiency can be improved. Every effort has been given to increase the time and labor saving features of these machines without impairing their sturdiness and permanent accuracy.

Heavy Duty Bench Saw

$28.00 (less motor)



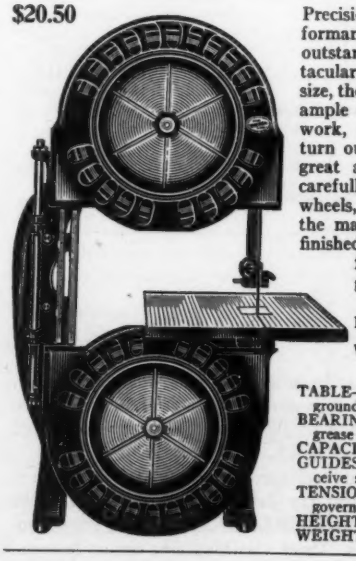
A new, heavy duty fast cutting saw that is ideally suited for school shop use. This saw is extremely low in price and of large capacity. It has a high grade combination 8" saw that can be instantly raised or lowered with a convenient hand-wheel. Timken Bearings assure efficient, frictionless performance over a long period of years. Table tilts easily and quickly to 45°. Hardwood insert in table is readily removable for dadoing, grooving, and disc sanding.

Specifications

Table Size 13½" x 17".
Tilts to 45°.
8" Combination Saw Blade.
Rip Gauge Tilts to 45°.
Graduated Mitre Gauge.
Approved Safety Guard.
½ H.P., 3500 R.P.M. Motor.
Operates from any electric socket.
Height overall 15".
Length overall 27".
Depth of Cut 2¼".
Shipping Weight without motor 80 lbs.
Shipping Weight with motor 110 lbs.
Unit Motor Base.

"Driver" 12" Band Saw

$20.50



Precision, accuracy, and performance are just a few of the outstanding features of this spectacular tool. Though small in size, the "Driver" Band Saw has ample capacity for large heavy work, and in addition it will turn out the smallest work with great accuracy and safety. So carefully have the frame, guides, wheels, and all other parts of the machine been designed and finished that dependable, trouble-free service is assured and guaranteed.

Specifications

FRAME—Close-grained, hollow column, unusually rigid.
WHEELS—Disc type reinforced with ribs, balanced, rubber faced.
TABLE—12" x 11" cast iron, surface ground, tilts to 45°.
BEARINGS—Oversize, bronze, with grease reservoir.
CAPACITY—6" stock.
GUIDES—Hardened steel discs receive saw thrust.
TENSIONER—Enclosed spring type, governs alignment of wheels.
HEIGHT—34" overall.
WEIGHT—(Shipping) 72 lbs.

"Driver" Drill Press

This high speed precision machine performs drilling, mortising, carving, shaping and routing with equal accuracy. Its, low cost meets the need of present-day economy—the variety of work which it performs makes it extremely useful in every school. Examine the partial list of features below, and see how advanced in design this drill press is.

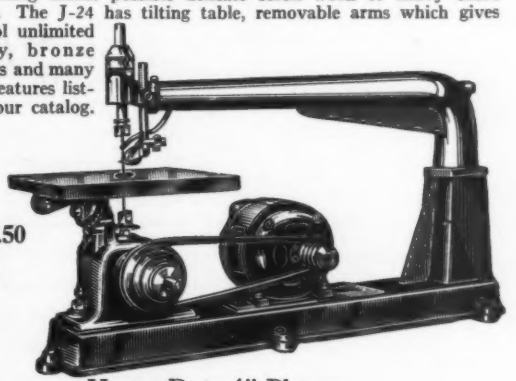
$26.25 (less motor)

Specifications

1—Positive lock holds quill in position.
2—Rustproof heavy steel column.
3—Depth gauge readily adjustable.
4—Jacobs ½" key type chuck.
5—Table tilts to 45°.
6—SKF Ball Bearings.
7—Table 9" x 8".
8—4-Step Motor Pulley.
9—Quick belt adjustment.
10—Removable driving head.

"Driver" Jig Saw

The "Driver" J-24 Jig Saw is perfectly balanced. Its keen effortless cutting makes possible delicate scroll work or heavy sabre sawing. The J-24 has tilting table, removable arms which gives the tool unlimited capacity, bronze bearings and many other features listed in our catalog.

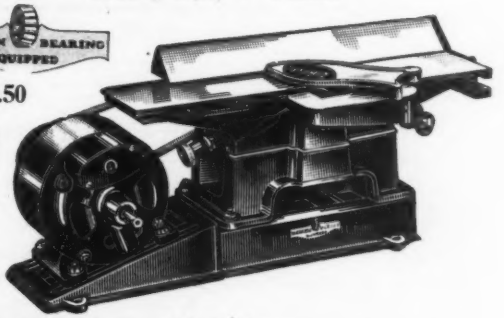


$20.50 (less motor)

Heavy Duty 4" Planer

TIMKEN BEARING EQUIPPED

$20.50 (less motor)



The extremely low cost of this 4" planer makes it available even to those schools with small tool appropriations. Accurate, speedy, dependable, this outstanding little tool performs perfectly. It deserves your careful consideration.

Length overall—19".
Fence—17".
Weight—92 lbs.
Height—8¾".
Speed—4000 R.P.M.
Motor Required—½ H.P.
Tungsten Steel Knives.

STUDENT PROGRESS CARD

NAME OF STUDENT Period Home Room Section

CITIZENSHIP—[ ] Reliability: Keeps his word, is trustworthy. [ ] Co-operation: Works well in a group. [ ] Obedience: Respects law and order, is willing to follow directions. [ ] Self-control: Keeps temper, cheerful under difficulties. [ ] Thrift: Makes good use of time and cares for personal and public property. [ ] Courtesy: Respects the opinions and rights of others, attentive when others talk, polite in speech and action.
In rating Citizenship traits: A means Excellent; B means Satisfactory; C means Unsatisfactory. Check this item every six weeks.

Group	Unit	Lesson	DESCRIPTION	Date and Time Commenced	Time Finished	Total Periods	Grade

McKinley High School Print Shop, Canton, Ohio

Face of Student Progress Card. Original Size 8 by 5 in.

Group	Unit	Lesson	DESCRIPTION	Date and Time Commenced	Time Finished	Total Periods	Grade

REMARKS

Reverse of Student Progress Card

(Continued from page 88)

few minutes. The instructor should use red ink in marking all omissions or errors made by the student in filling out this card.

The graph card also was designed to stimulate the student's interest in his work and to raise the standard of his accomplishments. It enables the trade instructor to keep closer track of each student's ability and allows him to more effectively guide the student along the line of work to which he is best adapted. It also aids the instructor to more intelligently recommend his students for positions after they have finished their course.

The printing course has been divided into four blocks; viz., composition, stonework, presswork, and bindery. A graph card has been devised for each of these, and each one is printed on a distinctively colored stock.

The graphs are spaced off for a six-week report, with a rating index from 5 to 100. On the reverse side of each of the cards is the numbered classification of work which comes under that particular block. These classifications are as follows:

(Continued on page 100)

ADVERTISING PAGES REMOVED

Metal-Working Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.	Name and Description	No.
Air Compressors, for machine shop, foundry, or forge shop		**Desk**		Change gear, 9" to 14" swing, 18" to 36" between centers	
Anvil, 100-lb.		Teacher's, with drawer compartments		Quick-change gear, 9" to 16" swing, 18" to 36" between centers	
Arbor Press, bench or pedestal type		Chair, to match desk		Semiquick-change gear, 9" to 18" swing, 18" to 42" between centers	
Barrows		**Die-Filing Machine**		Turret	
Coke		**Dividing Head**		**Milling Machine**	
Foundry		**Drill**		Plain, cone or motor-driven type	
Scrap		Bench, hand		Universal, cone or motor-driven type	
Belt Lacer		Breast		**Nibbling Machine**	
Benches		Electric, portable		**Pipe Cutter**	
Coremaking		Hand		**Planer,** belt or motor driven	
For metal working, iron or steel legs. Tops metal or hardwood lumber 1¾ to 2½ in. thick		Post, hand or power		**Power Hammer,** for forging operations	
Molding		Radial		**Punches,** metal, hand or power	
Blackboard		Sensitive		**Pyrometer**	
Permanent or portable		Upright, power		**Pyroscope**	
Blowers, for furnaces, forges, etc.		**Flasks,** 2 or 3 part, steel or snap type		**Relieving attachment for Lathe**	
Blowtorch, 1-qt. size		**Forge,** coal or gas, with hand- or electric-driven blower		**Sandblast Outfit,** with cabinet	
Bookcase		**Furnaces**		**Sand Sifter,** for foundry, hand or power	
For reference books, catalogs, etc.		Annealing		**Scale**	
Boring Bar		Bench		Counter, for machine shop	
Boring Mill, vertical or horizontal		Brass and soft metal		Platform, for foundry, 1000-lb. capacity	
Bulletin Board		Combination bench		**Shaper**	
Cabinets, wood or metal, for filing class records, instruction sheets, drawings, etc., or for tools and supplies		Casehardening		**Slotter**	
Casehardening Boxes		Cyanide		**Snap-Flask Jackets,** to fit snap flasks used	
Centering Machine		Gasoline		**Straightening Press**	
Chain Hoists, differential, duplex or triplex		Heat treating		**Surface Plates**	
Chairs, tablet-arm if needed for related-subjects room, or demonstration section		Melting		**Swage Block and Stand,** for forge shop	
Chuck		**Gear-Cutting Machine**		**Taper Attachment for Lathe**	
Drill, selected sizes, each		**Grinder**		**Truck,** warehouse	
Lathe, combination, 4-jaw, selected sizes, each		Bench, hand or power driven		**Tumbling barrel,** for the foundry	
Lathe, independent, 4-jaw, selected sizes, each		Combination grinder, buffer and polisher		**Vises**	
Lathe, universal 3-jaw, selected sizes, each		Emery, bench or pedestal type		Blacksmith	
Milling machine, universal		Face, with magnetic chuck		Drill press	
Core Oven, for foundry		Portable tool post		Machinist	
Cranes and Hoists, air, electric or hand, of the jib, traveling, or portable type		Precision, for external and internal grinding		Pipe	
Cupola, for foundry, coke or electric, ¼ to 1-ton capacity		Universal tool-cutter, drill and reamer grinder		Planer	
		Wet tool		Shaper	
		Hand Picks, for cleaning inside of cupola, 1¼ to 2½ pounds		**Welding Outfit**	
		Hack Saw, motor or belt driven		Acetylene	
		Hardness Testing Machine		Electric	
		Lathes, belt or individual drives			
		Automatic			
		Bench, 6" to 11" swing, 11" to 36" between centers			

Metal Working—Small Tools

Name and Description	No.	Name and Description	No.	Name and Description	No.
Arbors		ers and shell drills, selected sizes, each		Core box	
Drill chuck to suit requirements		**Bearing Scraper, sets**		Core painting	
Reamers, various sizes, each		**Bellows,** for foundry class		Hard brushes for the foundry	
Shell tool, various sizes, each		**Bevel Protractor**		Soft brushes for the foundry	
Straight shank for shell reamers and shell drills, selected sizes, each		**Brooms and Floor Brushes,** for shop and foundry		**Bulb Sponges,** for molders	
Taper shank for shell ream-		**Brushes**		**Draw Pins,** for molders	
		Bench		**Calipers**	
				Hermaphrodite, 4"	
				Hermaphrodite, 6"	

(Continued on page 96)

Chicago Flexible Shaft Company

5529 W. Roosevelt Road, Chicago, Illinois

HENRY G. HOSS 4801 Park Ave. Indianapolis, Ind.	A. E. GOLDIE 561 East 108th St. Cleveland, Ohio	BERT L. SYLAR P. O. Box 3074 Chattanooga, Tenn.	J. W. LAZEAR 11 West 42nd St. New York City, N. Y.	J. W. BLACK 19 Sidney St. East Haven, Conn.	WESSENDORFF, NELMS & CO. 317 Preston Ave. Houston, Tex.
PFAFF AND BATHKE 1957 University Ave. St. Paul, Minn.	E. P. MACHOVEC 306 N. Ewing Ave. St. Louis, Mo.	JOHN J. NORMOYLE CO. 607 Third Ave. Moline, Ill.	R. C. SCHWARZ 943 Granite Bldg. Rochester, N. Y.	P. R. GRAM 510 Everett St. Lansing, Mich.	R. C. SPERRY 604 Chamber of Commerce Bldg. Pittsburgh, Penna.
FREDERIC A. TAYLER Richmond Trust Bldg. Box 1726, Richmond, Va.	R. C. JORDAN 1701 Arch St. Philadelphia, Penna.	DON C. CAMPION 4619 Woodward Ave. Detroit, Mich.	C. M. BIGGER CO. 332 Sycamore St. Cincinnati, Ohio	PAUL SLADKY 3906 N. 19th St. Milwaukee, Wisc.	Canadian Factory and Office FLEXIBLE SHAFT CO., Ltd. 349 Carlaw Ave., Toronto, Ont.

Manufacturers of

Industrial Furnaces

The selection of the proper heat treating equipment for educational and experimental purposes is extremely important, for it is while learning that the student receives his strongest and often lasting impressions, not only of methods but also of means.

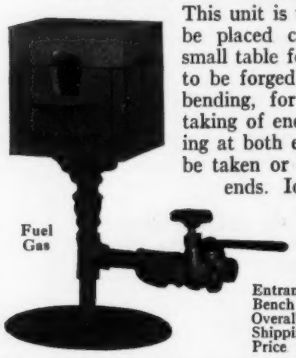
The furnaces shown on this and the opposite page represent latest developments and the finest equipment of its kind which can be constructed. While showings here embrace only small furnaces or combinations of small

STEWART

furnaces, complete information and catalog will be sent upon request should it be required for the installation of larger furnaces.

Stewart Furnaces for educational purposes are designed, constructed, and operated very much the same as those used for large production work in the industrial field. Hence, learning this work with these Stewart Furnaces renders the student familiar with his heat treating equipment when entering the industrial field.

No. 152 Forge—Ideal for Small Work



This unit is very handy and one that can be placed conveniently on a bench or small table for the heating of small pieces to be forged, for the heating of rods for bending, for tool dressing, and for the taking of end heats. It has a small opening at both ends so that center heats can be taken or it can be worked from both ends. Ideal where a quick intense heat is required. The top is removable so that a wide variety of work can be handled.

Entrance.....1¼" x 1¼"
Bench space.....12" x 12"
Overall height .....15"
Shipping weight.....60 lbs.
Price $15.00

No. 2M Combination Soldering Iron Heater and Melting Pot

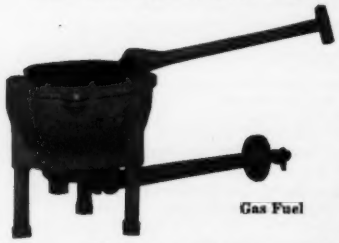
A very compact, solidly built and efficient gas heater for Soldering Irons. The flame is projected upward from the bottom and surrounds the irons, heating them rapidly and uniformly. Heavy cast iron body, lined with heavy firebrick. Retains the heat and does not burn out.

Pot on top for melting soft metals.

Will accommodate two 4-lb. irons.

Floor space.....16" x 11"
Atmospheric or blast burners
Shipping weight.....100 lbs.
Price $22.00

No. B40 Bench Soft Metal Melting Furnace

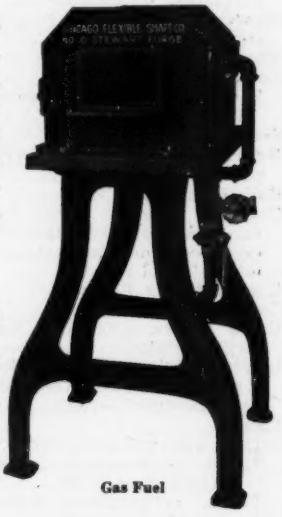


Although small in size, this unit has a capacity of 40 lbs. of lead. Suitable for the melting of any soft metals.

Cast iron shell, lined with insulation, and fitted with a cast iron pot with handle for removing and pouring. Atmospheric Burner.

Pot.....6" diameter x 5" deep
Bench space.....12" x 20"
Height .....10"
Shipping weight.....55 lbs.
Price $22.00

No. 0 Stewart Forge



This forge is very popular for tool dressing and general forging work. Combustion takes place immediately over the hearth. Burners staggered on both sides and placed in such a way as to give a quick, positive and uniform heat throughout the chamber.

Front opening .....
.....3½" high x 5" wide
Heating depth.....7"
Rear Opening...3¼" diameter
—same as front if specified.
Floor space.....22" x 22"
Shipping weight.....450 lbs.
Price.....$80.00

SK 248 Forge

A sturdy, well built forge designed for tool dressing, rod end work, heating for bending, welding, the taking of center heats, and many other purposes where a fast high heat is required. Welding temperature secured in 20 minutes. Fitted with air curtain in front to protect the operator and equipped with a proportional gas and air mixer and a quenching tank with rack for tongs.

Opening.....4" wide x 2" high
Heating depth.....8"
Rear opening.....3"diameter
Shipping weight.....450 lbs.
Price $135.00

Chicago Flexible Shaft Company, Continued

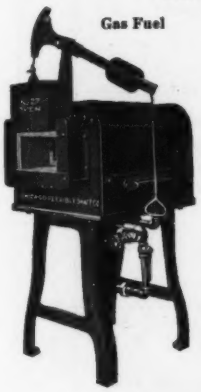
No. 4A Bench Metal Melting Furnace

This melter is fitted with a No. 4 Graphite crucible, lined with heavy firebrick and fitted with a swinging cover for the melting of brass, copper, and aluminum. Fast, quick heats assured.

Gas Fuel

Height .....19"
Bench space.....20" x 24"
Shipping weight.....180 lbs.
Price $40.00

Stewart No. 27 Oven

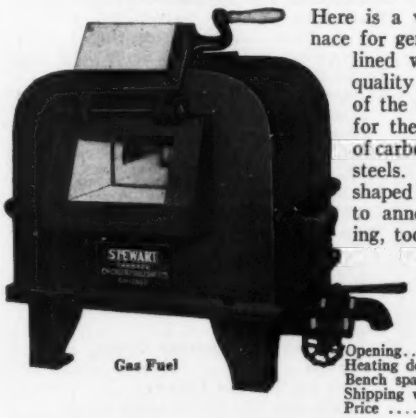


Gas Fuel

Indirect heat and equipped with a U-shaped hearth slab so that no flame comes in direct contact with the work. Will handle a wide variety of work, such as annealing, carburizing, tool and die hardening, tempering and general heat treating suitable for temperatures not exceeding 2000 deg. Fahr. Can be furnished for higher temperatures if desired at a small extra charge. Other standard sizes in this same type of furnace.

Door opening.....6" high x 12" wide
Heating depth.....18"
Floor space.....36" x 40"
Shipping weight.....1450 lbs.
Price $199.00

Stewart No. 28 Bench Oven



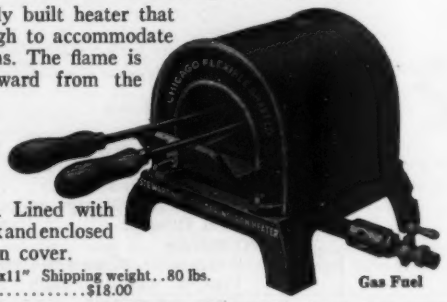
Here is a very handy furnace for general shop work, lined with heavy first quality refractories and of the under-fired type, for the heat treatment of carbon and high speed steels. Fitted with U-shaped hearth. Adapted to annealing, carburizing, tool and die hardening, and general heat treating.

Gas Fuel

Opening..4" high x 8" wide
Heating depth .....12"
Bench space.....24" x 24"
Shipping weight.....550 lbs.
Price $110.00

No. 1 Stewart Soldering Iron Heater

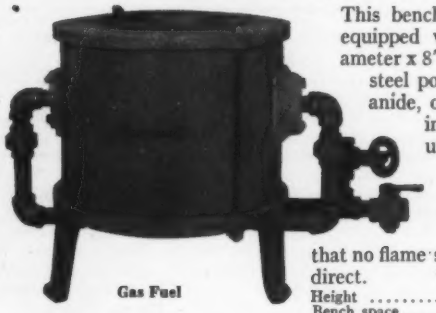
A very solidly built heater that is large enough to accommodate two 4-lb. irons. The flame is projected upward from the bottom and thoroughly envelops the irons with a rapid uniform heat. Lined with heavy firebrick and enclosed in a sheet iron cover.



Bench space..16"x11" Shipping weight..80 lbs.
Price.....$18.00

Gas Fuel

No. B68 Round Pot Furnace



This bench type unit is equipped with a 6" diameter x 8" deep pressed steel pot for lead, cyanide, or salt hardening. Can also be used for oil tempering. Lined with heavy refractories and fired so that no flame strikes the pot direct.

Gas Fuel

Height .....19"
Bench space .....20" x 24"
Shipping weight.....170 lbs.
Price $40.00

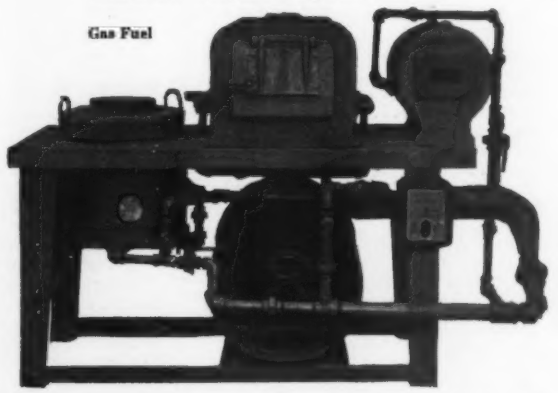
No. 51 Bench High Speed Oven

This small under-fired furnace designed for high speed steel hardening where quick, high heats are essential has a carbofrax U-shaped hearth and no flame can strike the work direct. Suitable for temperatures of 2450 deg. Fahr. Built of Stewart quality throughout.

Gas Fuel

Opening..3" high x 5" wide
Heating depth.....6"
Bench space.....20" x 13"
Shipping weight...200 lbs.
Price $67.00

Stewart Triple Purpose Furnace



Gas Fuel

This very complete and compact unit is very popular for educational purposes and the toolroom—an assembly of three of our standard Stewart Furnaces making a complete, compact plant covering practically the whole range of the heat treatment of metals on a small scale.

Crucible section for lead, cyanide, or salt hardening fitted with 6" x 12" pressed steel pot. Interchangeable to accommodate a No. 12 graphite crucible for metal melting.

Oven section for general heat treating of carbon or high speed steels.

High speed section for tool dressing, rod end work, and forging.

The illustration above shows a Turbo Blower mounted below the table with push button starter.

A very complete and space-saving unit. Can be furnished in other combinations.

(Continued from page 93)

Name and Description	No.	Name and Description	No.	Name and Description	No.
Inside, 4".....		Flat bastard, 8" and 10", each		**Punches**	
Inside, 6".....		Half-round, double cut, 6", 8", and 10", each.....		Center, ¼" and 3/16", each....	
Outside, 4".....		Hand, smooth, 8" and 10", each		Hollow, ½", ¾", and 1", each	
Outside, 6".....		Mill, smooth, 8" and 10", each		Pin, 1/8", 5/32", 3/16", 7/32", and ¼", each	
Cans		Round bastard, 8".....		Prick, ¼".....	
Oil, ½-pt.....		Square bastard, 8".....		**Rammers**	
Oil, 1-pt.....		Swiss, various shapes, each.		Hand, for foundry.....	
Oil, 10-gal.....		Three-square, double cut, 6"		Floor, for foundry.....	
Waste		Warding, double cut, 6".....		**Reamers**	
Center Testers		**First-Aid Cabinet and Supplies**		Adjustable, various sizes, each	
Chisels		**Forge Tools**		Hand, various sizes, each...	
Cape, 3/8" and 5/8", each.....		Drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop.		Taper pin, various sizes, each	
Cold, 5/8" and ¾", each.....		**Gate Sticks,** maple, for foundry		With taper shank, various sizes, each	
Diamond point, 3/8" and ½", each		**Gauges**		**Riddles,** ¼" and ½" mesh, 18" diameter, for the foundry, each	
Round nose, 3/8" and ½", each		Center		**Rivet Sets,** assorted sizes, each	
Clamps, 4" and 6", each.....		Depth		**Scales**	
8" and 10", each.....		Drill and wire.....		Steel, 6", graduated 1/64" to ½"	
Flask, for the foundry.....		Screw pitch, select kinds, each		Steel, 12", graduated to 32nds	
Strap, various sizes, each...		Surface		**Screw Drivers**	
Coke Forks, for foundry.....		**Gloves,** asbestos, for foundry		6" blade.....	
Collets		**Goggles**		9" blade.....	
For milling machine, selected sizes, each		For machine shop.....		**Scribers**	
For lathe, selected sizes, each		For foundry		**Shovels**	
Combination Squares, with hardened head and blade, and protractor head, 9" and 12", each		**Hack Saw**		Coke	
Counterbores, straight and tapered chanks, selected sizes, each		Blades, hand, 18T, 10", doz..		Sand	
Countersinks, for metal.....		Blades, power, 14T, 12", doz.		**Snips**	
Crucibles, of suitable sizes, each		Frames, adjustable		Straight, 3" cut.....	
Shanks, single, end to fit ladles		**Hammers**		Curved, 3" cut.....	
Shanks, hand, to fit ladle bowls		Babbitt		**Sockets,** for taper shanks, drill and tools, selected sizes, each	
Crucible Tongs, to fit crucibles, each		Ball-peen, 13-, 16-, or 20-oz..		**Soldering Coppers and Handles,** 1-lb. size.....	
Cutters		Blacksmith's, various kinds, each		**Spray Can,** for molders.....	
Angular-milling		Riveting, 9- and 12-oz., each.		**Sprinkling Cans,** galvanized iron, 16-qt. capacity, for the foundry	
Bevel-gear		Setting		**Sprue Picks,** for molders.....	
Concave-milling		**Indicator**		**Squares**	
Convex-milling		Center		Machinists', 6".....	
End-milling		Universal or universal dial test, each		Blacksmith's	
Face-milling		Speed		**Steel Figures,** ⅛", sets.....	
Formed-milling		**Knurling Tool,** with assorted knurls		**Steel Letters,** ⅛", sets.....	
Grooving		**Ladles**		**Swabs,** for molders.....	
Involute gear teeth.....		Bull		**Tapeline,** steel, 25'.....	
Key-seat		Hand bowls		**Taps and Dies**	
Side-milling		Melting		Machine Screws, sets.....	
Metal-slitting		**Lathe Dogs,** ½", ¾", 1", 1½", 2", 2½", and 3", each.....		Pipe, sets	
Dividers		**Leggins,** fireproofed duck, to protect students when pouring in the foundry, pairs....		S.A.E. ¼" to ¾", sets.....	
Spring, 4".....		**Level,** 6" bench.....		U.S.S. ¼" to ¾", sets.....	
Spring, 6".....		**Lifting Screws,** for molders...		**Tongs**	
Drill		**Mandrels,** selected sizes, each.		Blacksmith's, various kinds, each	
Drifts, different sizes, each..		**Mallets,** wood or soft face....		Pick-up, for the foundry....	
Drill sleeves, different sizes, each		**Micrometers**		Shake-out, for the foundry..	
Stand for Nos. 1 to 60.....		Inside, 1½ to 8".....		**Tool Holders**	
Stand for 1/16" to ½" by 64ths		Outside, 0" to 1".....		Boring tools	
Drills		Outside, 1" to 2".....		Cutting-off tools	
Center		Outside, 2" to 3".....		Planer	
High-speed, taper shank, various sizes, each.....		**Molding Boards**		R.H. and L.H. offset shank.	
Jobbers, straight shank, 1/16" to ½" by 64ths, each.....		**Molding Sticks and Trowels,** various kinds, each.....		Shaper	
Ratchet		**Nippers,** end-cutting, 5".....		Slotter	
Straight-shank, Nos. 1 to 60, each		**Oilstones,** medium and fine, each		Straight shank	
Taper shank, ⅛" to 1" by 16ths, each.....		**Oil Storage Tank,** with pump.		Threading	
Emery		**Pails,** galvanized, 12-qt. capacity for the foundry.....		**Tool-Holder Bits,** square, ¼", 5/16", 3/8", 7/16", ½"	
Rub-stones for cleaning castings in the foundry.....		**Parallels**		**Trammel Points,** sets.....	
File Card.....		Adjustable		**V Blocks and Clamps,** pairs...	
Files		Steel, assorted sizes, each...		**Wheel Dresser**	
Die sinkers, various shapes, each		**Pliers**		**Wrenches**	
		Combination, 6".....		Adjustable, 8" and 10", each.	
		Side-cutting, 6".....		Pipe, 8" and 12", each.....	
				Tap, adjustable, various sizes, each.....	

(Continued on page 98)

American Gas Furnace Co.

Elizabeth, New Jersey

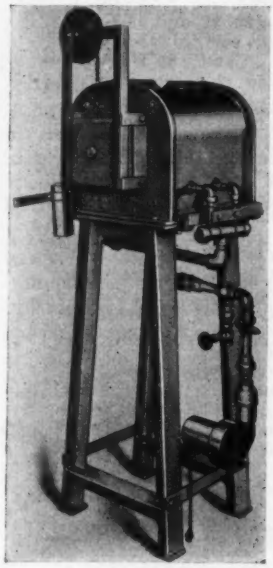
Manufacturers of

Industrial Heating Appliances

Over 50 years of practical experience is back of American Gas Furnace equipment. In using American furnaces, the student will become acquainted with the same type of equipment used in so many industrial plants.

American furnaces and equipment are modern in design and construction. Write for further details.

Our products include:
Automatic Heat Controllers; Automatic Quenching Tanks; Blowers; Blowpipes or Blowtorches, Hand and Stand; Brass Melters; Burners; Burners for Electric Lamp Bulb Manufacture; Carburizing Machines; Cyanide Furnaces; Cylindrical Furnaces; Forges; Heating Machines; Melting Furnaces; Muffle Furnaces; Oil-Tempering Furnaces; Oven Furnaces; Rivet Heaters; Soft Metal and Lead Hardening Furnaces; Tube-Heating Furnaces.



Oven Furnaces

The No. 96 high speed oven furnace and turbo blower with motor illustrated is especially adapted for schoolroom work. It is suitable for hardening, annealing, carburizing, and normalizing. For similar work where temperatures below 1800° F. will suffice our No. 16 Oven Furnace is recommended.

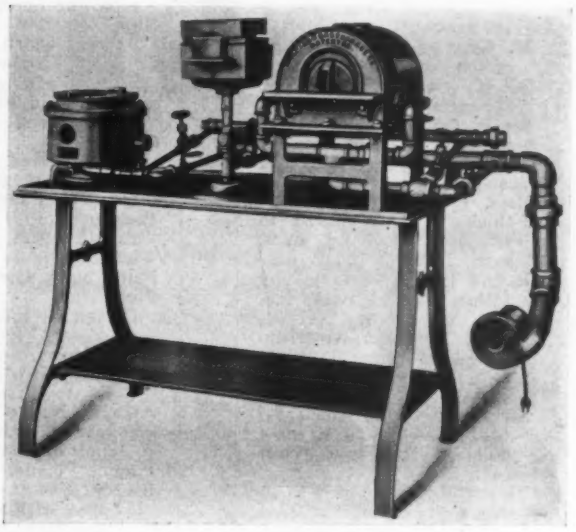
Furnaces can be supplied with or without individual blower illustrated in conjunction with the No. 96 Oven Furnace. These small blowers are very satisfactory, however, where a large main air supply is not available.

Special mixers to use compressed air where it is available can also be furnished.

Size No.	Size of Entrance Inches Height	Width	Available Heating Space Inches Width	Length
*16	3¼	8	8	12
96	5	5	5	9
**1	6	12	14	17

*Oven furnace with hinge type cast iron door.

**Supplied either with hinged type cast iron door or sliding fire brick door.



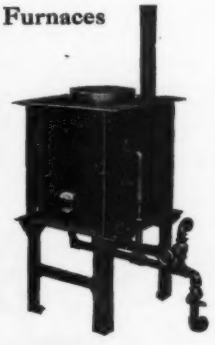
American Vocational School Table

This is a complete unit including an Oven Furnace, Forge, Pot Furnace and Blower ready to make a gas connection and plug the Blower into a light socket.
The Oven Furnace can be ordered with a muffle 2¼" high by 4¼" wide by 7½" deep, or with a hearth slab to give the same available heating space.
The pot in the Pot Furnace is 6" diameter by 5" deep. It can be used for lead hardening, lead or oil tempering or salt bath work.
The Forge has an available heating space 4" deep by 3" wide by 2" high. End bricks and cover brick are removable. A forging heat can be obtained in two minutes.
The table is 3' 9" by 21".
The turbo blower has a universal motor for A.C. or D.C. current and can be supplied for 110 volts or 220 volts. It supplies enough air to operate all three units simultaneously.
Variations of this table can be supplied as desired.

Soft Metal and Lead Hardening Furnaces

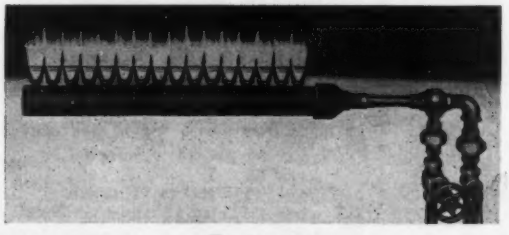
Soft Metal Furnaces are designed for melting lead, babbitt, etc., and, in fact, any substance which melts under 1000° F.

Lead Hardening Furnaces are equipped with stronger burners for maintaining temperatures as employed in the hardening of carbon steel, etc., and are especially adapted for the local hardening of parts.



No.	Dimensions of Pot Inches Diam.	Depth
*1	6	5
*3	11½	10½
**5	5	11½
**43	8	6½

*For soft metal.
**For lead hardening.



Burners

A wide variety of burners can be supplied according to the nature of the requirement to give a soft, focusless fire or a sharp, intense local fire. Ribbon Burners and equipment for manufacturing neon light signs are also supplied.

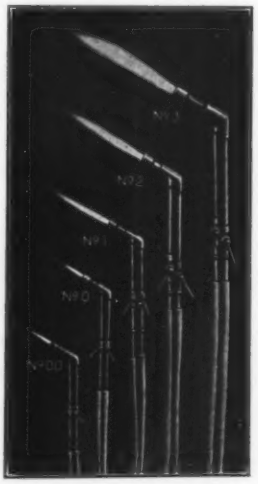
Blow Pipes

Used for soldering, brazing, annealing and hardening certain small work, sterilizing, melting, etc. These blowpipes are made in six sizes in both the hand and stand types, the flames ranging from a needle point up to 2-inch diameter by 9½ inches long.

The mixture of gas and air is perfect before it reaches the point of combustion. These blowpipes are so constructed that the maximum heat possible from the gas being used is obtained, and they burn well with producer gas, natural gas, artificial (city) gas, gasoline gas, bottled gas, etc. Air at one pound per square inch is required for their operation.

These blowpipes can be regulated to produce instantly, or gradually, from a soft mild flame to the strongest flame procurable.

Blowpipe No.	Size of Flame Inches Diam.	Lgth.
000	¼	3
00	⅜	3¼
0	½	4¾-5
1	¾	5¾
2	1	6½
3	2	9½



(Continued from page 96)

Metal Working—Materials and Supplies

Name and Description	No.
Abrasive Wheels	
Acetylene Gas, in drums, for welding	
Aluminum Pigs, for foundry	
Babbitt Metal	
Bearing Blue, tubes	
Belt Dressing	
Belt Lacing Material	
Belt Leather	
Bolts	
Carriage, selected sizes, lots of 100 each	
Lag, selected sizes, lots of 100 each	
Machine, selected sizes, lots of 100 each	
S.A.E., selected sizes, lots of 100 each	
Stove, flat or round heads, selected sizes, in lots of 100 each	
Brass	
Bars, 1/16", 1/8", 3/16", and 1/4" thick; 3/8" to 1" wide, 8' to 10' long, selected sizes, each	
Round Rods, 3/16" to 1/2" by 16ths, selected sizes, feet each	
Sheets, 28 to 32 American gauge, 12" wide by 72" to 84" long, selected sizes, sheets, each	
Strips, 1/32" and 1/16" thick, 1/2" to 1 1/2" wide, 50 ft. to a coil, selected sizes, coils each	
Threaded Rods, Nos. 6 to 10, come in 12" lengths. Nos. 12, 14, 1/4", and 5/16" come in 24" lengths, selected sizes, rods	
Wire, soft, 8, 11, and 14 American gauge, selected sizes, lb.	
Wire, spring, 8 to 22 American gauge, selected sizes, lb.	
Casehardening Compounds	
Chaplets, single and double head	
Coal	
Charcoal for foundry or forge	
Coke for foundry	
Forge	
Copper	
Pigs, for casting alloys	
Sheets, 8 to 25 American gauge. Size of sheets, 30" x 60". Selected sizes, sheets, each	
Tubing, outside diameters, 1/8", 1/4", 3/8", 1/2", 5/8", 3/4"; thickness of wall, 1/32", lengths, 8' to 12'. Selected sizes, lengths each	
Wire, soft, 2 to 20 American gauge, in coils. Also obtainable in 1/4-, 1/2-, and 1-lb. spools, in sizes 16 to 36 English gauge. Selected sizes, pounds each	
Core	
Compounds	
Flour	
Paste	
Oil	
Wax-vent wire	
Cutting Compounds	
Emery Paper and Cloth	
Nos. 00, 0, 1/2, 1, obtainable in sheets or rolls. Selected sizes. If in sheets, quires each	
In rolls, rolls each	
File Handles, assorted sizes, each	
Fire Bricks and Clay, for foundry	
Graphite, for foundry	
Iron	
Pig, for foundry	
Lacquer, transparent and colored, for finishing	
Nuts	
S.A.E., acorn cap, castellated, square, hexagon, joint, and wing. Selected sizes and kinds. Lots of 100 each	
Oil	
Boiled linseed, gal	
Lubricating, gal	
Quenching and hardening	
Packing	
Round, sheet, square, or tubular	
Paint, black asphaltum	
Pins	
Cotter, 3/32" to 1/4" diam. from 1/2" to 2" long. Obtainable in boxes containing an assortment of 120 cotters	
Flask, for flask repairs	
Taper, Nos. 0 to 6, 3/4" to 2" long. Obtainable in boxes containing 40 assorted pins	
Pumice Powder	
Rivets	
Copper, with burrs, Nos. 7 to 14, lengths, 3/8" to 3/4". Selected sizes, 1/2-lb. boxes, each	
Iron, No. 14 gauge to 3/16", flat-head or button-head, 1/4" to 1" long. Selected sizes, lb. each	
Tinners, flat-head, 8-oz. to 16-lb., either tinned or black. Selected sizes, lb. each	
Sand	
Molding, can be had in 350-lb. barrels or 800-lb. casks.	
Parting, can be had in 350-lb. barrels or 800-lb. casks	
Screws	
Flat-head or round-head, iron or brass. Selected sizes and kinds, per hundred, each	
Cap and machine, iron or brass. Selected sizes and kinds, per hundred, each	
Set, head and headless	
Solder	
Acid or rosin core; bar, or solid wire	
Soldering Paste or Salts	
Steel	
Bessemer, rod, 1/64" to 3/8" by 64ths, in 4' lengths. Selected sizes, lengths, each	
Bars, cold-rolled, 1/8" to 3/8" thick, 1/2" to 2" wide, 12' lengths. Selected sizes, lengths, each	
Drill rod, letter sizes, A to Z; number sizes, 1 to 80. Comes in 3' lengths. Selected sizes, lengths, each.	
Rods, hexagon and square, cold-rolled, 1/4" to 3/4". Comes in 12' lengths. Selected sizes, lengths, each.	
Round, cold-rolled, diameters 1/8" to 1", lengths 12'. Selected sizes, lengths, each	
Sheet, black, Nos. 18, 20, 22, 24, 26, 28 U.S. gauge; size of sheets, 24", 28", and 30"x 96". From 4 to 13 sheets in a bundle. Selected sizes, bundles, each.	
Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24", 28", and 30"x 96". From 4 to 12 sheets in a bundle. Selected sizes, bundles, each	
Threaded rods, Nos. 6 to 10. Come in 12" lengths. Nos. 12, 14, 1/4", and 5/16". Come in 24" lengths. Selected sizes, rods each	
Tin	
Pigs, for casting alloys	
1C, 1X, 20"x 48", 112 sheets to the box	
1XX, 20"x 48", 56 sheets to the box	
Washers and Burrs	
Copper, burrs, Nos. 3 to 14, in 1-lb. boxes	
Iron burrs, Nos. 3 to 14, in 1-lb. boxes	
Brass washers, 3/16" to 1/2" by 16ths	
Iron washers, 3/16" to 1/2" by 16ths	
Welding Fluxes	
Welding Rods, all rods come in 24" lengths	
Brazing, 1/16", 1/8", and 3/16" diameter	
Cast aluminum, 3/16", 1/4", and 3/8" diameter	
Cast brass, 3/16", and 1/4" diameter	
Cast bronze, 1/4" diameter	
Cast copper, 3/16" and 1/4" diameter	
Cast iron, 1/16", 1/4", 3/16", and 3/8" diameter	
Low carbon steel, 1/8", 3/16", and 1/4" diameter	
White Lead, for machine shop, lb.	
Wire	
Annealed, 16 to 34 English gauge. Selected sizes, lb. each	
Coppered market, 5 to 18 English gauge. Selected sizes, lb. each	
Coppered spring, 2 to 18 English gauge. Selected sizes, lb. each	
Galvanized, 5 to 18 English gauge. Selected sizes, lb. each	
Piano, 00 to 36. Selected sizes, lb.	
Tinned, 16 to 24 English gauge. Selected sizes, lb. each	
Wool, No. 0 to 3 in pound packages. Selected sizes, lb. each	
Zinc	
Pigs, for casting alloys	
Sheet, Nos. 4 to 14. Sheets 36"x 84"	

The Standard Electrical Tool Co.

Established 1912

West Eighth St., Viaduct Cincinnati, Ohio

Manufacturers of

Electric Drills, Grinders and Buffers

STANDARD ELECTRIC TOOLS have special merit that is commended for School Shop Service. They are designed for efficient operation and longevity. GENERAL ELECTRIC motors are used throughout in all Standard Tools.

Standard Portable Electric Drills

¼" Special, ¼", 5/16" and ⅜" Heavy Duty Drills.

Universal Motors for operation on alternating or direct current and SKF ball bearings are used. The gears are made of Chrome Nickel Steel, heat-treated and run in grease, thereby aiding quietness and smoothness of operation. Equipped with Jacobs 3-jaw geared chuck and key.

Standard ⅜", ½" Special, ½", ⅝", ¾", ⅞", 1", 1¼" and 1½" Heavy Duty Drills are all constructed identical to the above in proportion to size. These types of drills are similar to the Drill mounted in the Bench Drill Stand shown below. The ¾" and larger size Drills are fitted with Morse Taper Sockets.

Standard Bench Drill Stand

This combination of Drill and Stand makes an efficient and economical piece of Shop equipment for all kinds of bench drilling. A Stand can be furnished for any of the above size Drills and is arranged for easy mounting of the Drill.

Standard Universal Motor Aerial Grinders

Anti-friction bearings. Trigger Switch.
¼ H.P. 5" x ¾" wheel; ¾ H.P. 6" x 1" wheel.
Other Aerial Grinders made in sizes of ½, 1, 2 and 3 H.P.

Standard Tool Post and Center Grinders

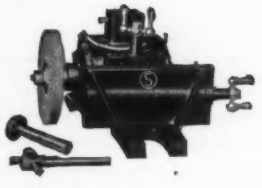
Excellent tools for work on Lathe, Shaper, Planer or Milling Machine. Made in sizes of ¼ and ½ H.P. Can be furnished with horizontal hand feed.

Standard Pedestal Grinders

Sizes ¼, ½, 1, 2, 3 and 5 H.P. Also made in Bench Type. SKF ball bearings. Enclosed Adjustable Safety Type Guards. Cone Wheel and Guard furnished at small additional charge. **Wet Tool Grinder, heavy type.**

Standard Combination Grinder and Buffer

Construction and sizes identical to the Pedestal Grinder illustrated above. An excellent tool where grinding and buffing equipment is required. Three SKF ball bearings are mounted on the armature shaft.

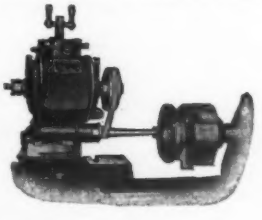


Standard Angle Plate Grinders

Parallel and roll grinding of every description can be done with this machine. Can be mounted on Lathe, Planer, Boring Mill, Shaper, and other machine tools. Sizes ¼ H.P. up to 10 H.P. Also furnished with vertical or horizontal feed.

Standard High Speed Internal-External Grinders

Sizes ¼, ½ and 1 H.P. Speed up to 20,000 R.P.M. SKF Precision Ball Bearings.



Standard Bench Buffing and Polishing Machines

Sizes ½, 1, 2, 3 and 5 H.P. SKF ball bearings mounted in dust proof chambers. Also Pedestal Types.

WRITE FOR COPY OF COMPLETE CATALOG

The Standard Electrical Tool Co., West Eighth St. Viaduct, Cincinnati, Ohio.

(Continued from page 90)

Composition

1. Abbreviations and signs.
2. Booklets, their use and construction.
3. Books on typography.
4. Brass rules and their uses.
5. Capitals and small capitals.
6. Cleaning cases.
7. Cleaning shop.
8. Composing-room furniture.
9. Compositor's tools and materials.
10. Compound words.
11. Correcting.
12. Display composition.
13. Distribution (300).
14. Division of words.
15. Errand.
16. English for printers.
17. Foreman.
18. History of printing.
19. Inventory.
20. I.T.U. course.
21. Layout.
22. Lecture (200).
23. Lettering.
24. Making out graph cards.
25. Make-up.
26. Miscellaneous (600).
27. Notebook work.
28. Office work (100).
29. Plain book composition.
30. Preparation of printer's copy.
31. Principles of typesetting.
32. Production work.
33. Proofing.
34. Proofreading.
35. Proofreader's marks.
36. Publicity forms.
37. Setting plain matter.
38. Shop mathematics.
39. Small commercial forms.
40. Social forms.
41. Style aids in composition.
42. Studying.
43. Spacing materials.
44. Tabular composition.
45. Test (500).
46. The printing industry.
47. The printer's system.
48. The use of italic.
49. Type.
50. Type calculations.
51. Type cases.
52. Type faces, classifications, legibility.
53. Typesetting — straight.
54. U.T.A. library volumes.
55. U.T.A. course.

Presswork

1. Bronzing.
2. Cleaning press.
3. Cutting and creasing make-ready.
4. Embossing.
5. Foreman.
6. Harmony of colors.
7. Halftone work.
8. Intaglio processes of engraving and printing.
9. Learning to run press.
10. Linoleum block printing.
11. Making ready on press.
12. Mixing inks.
13. Numbering.
14. Oiling.
15. Parts of the press.
16. Platen-press feeding.
17. Platen printing presses.
18. Power for machinery in printshop.
19. Press preparation.
20. Presses in America.
21. Presswork and its history.
22. Printers' ink.
23. Printers' rollers.
24. Printing plates.
25. Relief processes of engraving and printing.
26. Registering.
27. Safety devices.
28. Slip-sheeting.
29. Stockograph work.
30. Surface processes of engraving and printing.
31. Test (500).
32. U.T.A. course.
33. U.T.A. library volumes.
34. Washing up.

Stonework

1. Foreman.
2. Imposition.
3. Imposition tables.
4. Lock-up appliances.
5. Locking up forms for the press.
6. Foundry lock-up.
7. Make-up.
8. Production work.
9. Proof presses.
10. Stone proof.
11. Stone layout.
12. Test (500).
13. U.T.A. course.
14. U.T.A. library volumes.

Bindery

1. Bookbinding.
2. Counting.
3. Cutting ruled stock.
4. Cutting.
5. Estimating.
6. Figuring stock.
7. Finishing operations.
8. Folding.
9. Foreman.
10. Gathering.
11. History of paper.
12. Inserting.
13. Jogging.
14. Lacing.
15. Making dummies.
16. Padding.
17. Pamphlet binding.
18. Paper.
19. Paper-cutting machines.
20. Papermaking.
21. Preparing books for repair.
22. Preparing covers.
23. Punching.
24. Separating.
25. Stitching and trimming.
26. Test (500).
27. Tying.
28. U.T.A. course.
29. U.T.A. library volumes.
30. Wrapping.

No. 1 COMPOSITION

Name

Print Shop Graph

McKINLEY HIGH SCHOOL, CANTON, OHIO

-------Six Weeks Report.
See other side for work classified under composition.

	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	
100																															100
95																															95
90																															90
85																															85
80																															80
75																															75
70																															70
65																															65
60																															60
55																															55
50																															50
45																															45
40																															40
35																															35
30																															30
25																															25
20																															20
15																															15
10																															10
5																															5

Print Shop Graph Card. Original Size 8 by 5 in.

By drawing in the graph and marking in the numbered classification the instructor knows the ability of the student at all times.

The student should transfer his grades from the "Student Progress Card" to the graph card once a week. This will add a further incentive to him to better his work.

The graph cards should be kept in a heavy manila open-end envelope.

Morgan Vise Company

108 No. Jefferson St., Chicago, Ill.

Pacific Coast Office, 311 Minna St., San Francisco, Calif.

Manufacturers of

Wood and Metalworking Vises

Morgan vises are guaranteed against breakage and we will replace free of charge any part broken in service. Morgan Woodworking Vises are distinguished by their simplicity of construction, and every part is accurately machined and interchangeable. In Morgan Metalworking Vises, the sliding bar is solid instead of cored all the way through as in other vises.

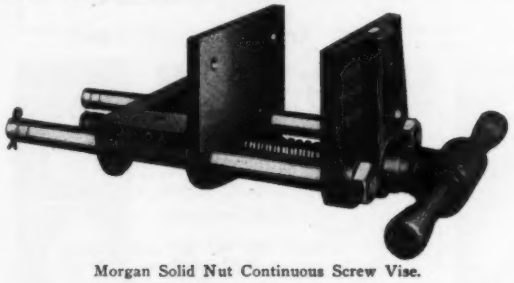
Continuous Screw Parallel Bar Vise

Adjustable Steel Handle—Stop in Front Jaw

Vise No.	Width of Jaw, Inches	Depth of Jaw, Inches	Jaw Opens Inches	Weight Pounds
210A	7	4	9	24
215A	8	4	10	27
220A	10	4	12	31

Solid Nut Continuous Screw Woodworking Vise

Side bars of ⅞" cold rolled steel with heavy shoulders fitting well into the movable jaw add strength and rigidity. Screw is 1" in diameter with three Acme threads to the inch assuring easy rapid action. Solid bronze nut is removable.



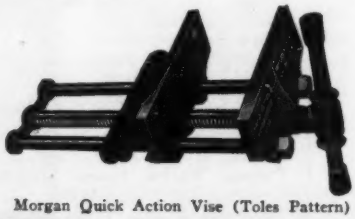
Morgan Solid Nut Continuous Screw Vise.

Vise No.	Width of Jaw Inches	Depth of Jaw Inches	Jaw Opens, Inches
10A	7	4	8½
15A	8	4	10
20A	10	4	12

No. 10A Vise can be furnished with 12-inch opening if so desired.

Quick Action Vise (Toles Pattern)

The working action of this vise is the most simple and effective of any of the screw adjusting type. The screw, having intercepted threads, operates in a half nut, a slight turn of the handle disengaging the screw and permitting the jaw to slide back and forth at will. A turn in the opposite direction engages screw with nut, holding the work firmly in place.

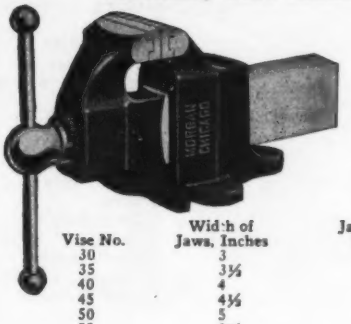


Morgan Quick Action Vise (Toles Pattern)

Screw is 1¼" in diameter. Half nut is a high quality bronze casting with accurately cut threads. This vise can be furnished either with or without dog in the front jaw. Whenever dogs or stops are furnished they are accurately fitted into machined holes having cored openings at their bottoms to permit the passage of dirt and chips.

Vise No.	Width of Jaw Inches	Depth of Jaw Inches	Jaw Opens, Inches
100	7	4	8
200	10	4	12

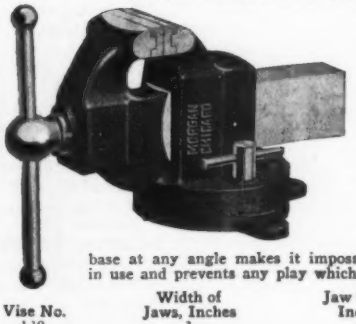
Stationary Base Machinists' Vise



This vise is unsurpassed for strength, rigidity, and durability. All parts are interchangeable because of the use of special machining processes.

Vise No.	Width of Jaws, Inches	Jaw Opens, Inches	Weight Pounds
30	3	4	22
35	3½	5	29
40	4	5½	42
45	4½	6¼	55
50	5	7	70
55	5½	8½	100
60	6	9½	135
70	7	12	200
80	8	12	250

Swivel Base Machinists' Vise

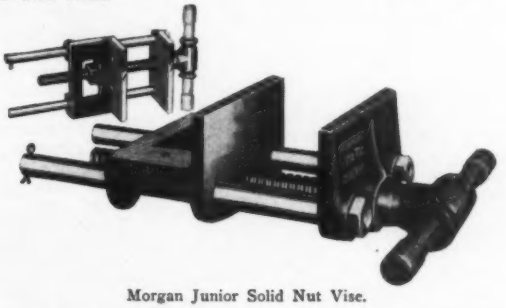


All the strength and rigidity of the Morgan Stationary Base Vise is maintained in the Swivel Base series. All engaging parts are milled to insure smooth and perfect working. The same careful workmanship and close and high standard of inspection is maintained in the manufacture of this type of vise. This vise may be swung and clamped in any desired position; a specially designed nut for locking the base at any angle makes it impossible to turn the vise when in use and prevents any play which would destroy the rigidity.

Vise No.	Width of Jaws, Inches	Jaw Opens, Inches	Weight Pounds
130	3	4	28
135	3½	5	36
140	4	5½	52
145	4½	6¼	64
150	5	7	85
155	5½	8½	115
160	6	9½	150
170	7	12	220

Junior Solid Nut Vise

Built to meet the demands for a sturdy dependable vise at a low price. Especially adapted for the Elementary Manual Training shop or the home work bench.



Morgan Junior Solid Nut Vise.

Construction and workmanship of the same high quality as our regular line and also carries our unqualified guarantee against breakage.

Vise No.	Width of Jaw, Inches	Depth of Jaw, Inches	Jaw Opens, Inches
300	7	3	8½

Can be furnished with 12" opening if so desired.

Other Models

The Morgan Vise Company also manufactures a Combination Pipe Vise with swivel base that is so constructed as to embody the best features of our standard machinists' vise and the convenience of a pipe vise. This vise is made in width of jaw sizes of 3½, 4½, 5, and 6 inches.

Sheet-Metal Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.	Name and Description	No.
Bar Folder		**Marble Slabs**		**Detail Paper, 36" wide, 25-yd. rolls**	
20" size		**Melting Ladle, 5" bowl**		**Drawing Pencils, 4H., doz**	
30" size		**Oil Can**		**Ears**	
Beading Machine		½-pt. size		Wrought, No. 20, gross	
Beam Compass		1-gal. size		Wrought, No. 40, gross	
Benches, for sheet-metal work, with iron or steel legs. Tops of metal or hardwood lumber, 1¾" to 2½" thick		**Pliers, flat jaw, 8", pair**		Wrought, No. 60, gross	
Bench		**Punches**		**Erasers, doz**	
Grinder, hand or power		Hand		**Handles**	
Plates		Hollow, sets		Ash-can, tinned, 4", doz	
Punch		Prick		Dish-pan, tinned, 3", doz	
Vise, 5"		Solid, sets		File	
Blackboard, permanent or portable		**Scales**		Lard-can, drop, 3½", doz	
Blackboard Drafting Outfit for the teacher		Draftman's		Lid, 3½", doz	
Bookcase, for reference books, catalogs, etc		Steel, 12", graduated to 16ths		Soldering-copper	
Brooms and Floor Brushes		**Scratch Awls**		**Hinges, hasps, and other supplies required by the problems in the course**	
Brushes, counter		**Scrapers, plumbers**		**Knobs, enameled teapot, No. 53, with rivets, gross**	
Bulletin Board		**Screw Drivers**		**Lead, for punching blocks, 50-lb. pig**	
Burring Machine		6" size		**Lid Handles, 3½", doz**	
Large		12" size		**Pail Woods, enameled, 4", gross**	
Small		**Setting-Down Machine**		**Rivets, tinners**	
Cabinets, wood or metal for filing class records, instruction sheets, drawings, etc		**Shears**		10-oz. boxes	
Chairs, tablet-arm		Bench		12-oz. boxes	
Circumference Rules		Slitting Machine		1-lb. boxes	
Cold Chisels		Squaring, 30"		1½-lb. boxes	
Corner Crimper		Throatless		3-lb. boxes	
Cornice Brake		**Snips**		5-lb. boxes	
6'		2½" cut, pair		8-lb. boxes	
8'		3" cut, pair		**Sal Ammoniac, compressed, ½-lb. cakes**	
Crimping Machine		3" cut, right-hand cut for left-hand man, pair		**Screws**	
Cutting Nippers, pair		Curved-blade, pair		Sheet-metal	
Desk		Compound, pair		8x¾, boxes	
Teacher's, with drawer compartments		Hawkbill, pair		¼x⅞, boxes	
Chair, to match desk		Slitting, pair		Zinc-can	
Dividers, 10", pair		Trojan, pair		¾", gross	
Double Seaming Machine		**Soldering Coppers**		1¼", doz.	
Drawing Boards		2-lb., pair		2", doz.	
24"		3-lb., pair		**Sheet**	
48"		**Squares**		Brass, 28 to 32 American gauge, 12" wide by 72" to 84" long. Selected sizes, sheets, each	
Drawing Instruments, sets		Steel, 12"		Copper, 16-oz., 30"x96", sheets	
Drills, jobbers, selected sizes, each		Steel, 24"		Steel, black, 30"x96", 26 gauge, bundles	
Elbow Edging Machine, with turning rolls		**Stakes**		Steel, galvanized	
Electric Drill, ½", with stand		Beakhorn		30"x96", 20-gauge, bundles	
File Card		Bevel-edge, square		30"x96", 24-gauge, bundles	
Files, flat bastard, 12"		Blowhorn		30"x96", 26-gauge, bundles	
First-Aid Cabinet and Supplies		Bottom		30"x96", 28-gauge, bundles	
Forming Machine, slip roll		Candle-mold		Zinc, No. 27, 30"x96", sheets	
20" size		Conductor		**Solder, bar, half-and-half, lb**	
30" size		Creasing		**Soldering Flux, gal**	
Furnace, gas		Double-seaming		**Stove Bolts**	
Gas Lighters		Double-seaming, with removable heads		F.H., 8"x1", box	
Glass Tumblers, for flux		Hatchet		F.H., 8"x1", box	
Hack Saw		Hollow-mandrel		F.H., ¼"x1", box	
Blades, hand, 18T, 10", doz.		Needle-case		R.H., 8"x1", box	
Frames, adjustable		Round-head		R.H., 8"x1", box	
Hammers		Solid-mandrel		R.H., ¼"x1", box	
Raising		**Straightedge, steel, 96"**		**Thumb Tacks, boxes of 100 each**	
Riveting, ⅛"		**T Square**		**Tin Plate**	
Riveting, 1½-lb		24" size		1C, and IX, 20"x28", charcoal and coke, boxes each	
Riveting, 2½-lb		40" size		**Wire**	
Setting, ¾"		**Tongs, roofing, pair**		Coppered, No. 10, roll	
Hand Groovers, sets		**Trammel Points, pair**		Coppered, No. 12, roll	
Irregular Curves, selected sizes, each		**Triangles**		Galvanized, No. 10, roll	
Jars, stone, 1-gal. capacity		30-60 deg., 10"		Galvanized, No. 12, roll	
Mallets, hardwood or hard rubber		30-60 deg., 12"		Galvanized, No. 14, roll	
		45-deg., 8"		Stove pipe, No. 18, roll	
		45-deg., 12"			
		Turning Machine			
		Large			
		With elbow-edging rolls			
		Wiring Machine			
		Wire			
		Gauge, U. S. Standard			
		Reels			
		Wrenches, 10", monkey			
		Acid Swabs, gross			

ART METAL and JEWELRY WORK EQUIPMENTS and SUPPLIES

We make a specialty of equipping and supplying schools, clubs and summer camps for this work and carry all kinds of materials used, including gold, silver, copper, brass, pewter and nickel silver, in sheet and wire form, and semi-precious stones.

"Rose" anvils and hammers.

The first to be used in school work. Beware of inferior substitutes. **Specify "Rose"** when ordering.

We take pride in our reputation for service. No order or request too small to receive our prompt and careful attention.

Our Brochure "The Metal Crafts" is full of helpful suggestions. Sample copy sent free. Subscription price for three issues, 50c.

Send for our catalog R.

Metal Crafts Supply Co.
37 Aborn St., Providence, R. I.

UNIFORM

● **It makes no difference what the exercise may be, Kester Flux-Filled Solders are the one medium of solder and flux that impart a true and constant uniformity to the students' work.**

You, as the Instructor, can determine the exact amount of solder needed—and that amount is given the student with instruction on its use. Result—uniformity—credit—satisfaction. Write for our Plan and Samples. Kester Solder Co., 4231 Wrightwood Ave., Chicago, Illinois; Newark, N. J.; Brantford, Ont., Canada.

KESTER SOLDER

Oilstone Tool Grinders
and Grinding Attachments

Now Available in 3 sizes

No. 475 PLURALITY

Pioneering the field for over twenty years, the Mummert-Dixon Company developed the oilstone tool grinders which are now widely used. The COARSE OILSTONE WHEEL takes the place of the ordinary grindstone, is quicker, and more effective. The FINE OILSTONE WHEEL brings out the smooth, keen edge in one fourth the time required with a bench whetstone. The LEATHER STROPPING WHEEL finishes the edge to perfection. The GRINDING CONE does many odd jobs of internal grinding such as gouges and other tools of irregular shape. The EMERY WHEEL does all general grinding for the shop.

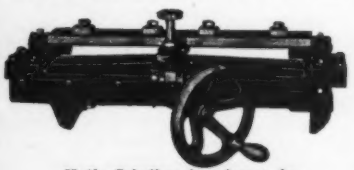
No. 475 Plurality Oilstone Grinder—This latest type compact oilstone grinder will rapidly grind and sharpen all woodworking tools such as plane bits, chisels, gouges and the various bench tools. Thoroughly guarded—a safe machine for school use. Each unit is thoroughly guarded and so located that the operator can use it without danger from other units.

Regular equipment includes one coarse and one fine oilstone wheel, one grinding cone, one grinding wheel, one leather stropping wheel, one tool holder; ½-H.P. motor either A. C. or D. C.; push-button switch, and cord and plug. Floor space 26"x36".

No. 450 Plurality Jr. Oilstone Grinder—The No. 450 is an adaptation of the No. 475. It has no leather stropping wheel, and with the exception of a slightly smaller grinding cone, the wheel equipment duplicates that of the No. 475. Floor space 20"x30".

No. 425 Plurality Sub-Jr. Oilstone Grinder—The No. 425 is strictly an oilstone tool grinder. Its essential equipment is two oilstone grinding wheels, a fine and a coarse, that are automatically saturated, and a grinding cone. Floor space 20"x22".

All three models are fitted with a tool holder with screw feed. Enables boys to do professional grinding of tools and plane irons.



Knife Grinding Attachment for No. 475 or No. 479 Grinder

Knife Grinding Attachment in position on No. 475 Plurality Oilstone Grinder

Knife Grinding Attachment

This hand-operated Knife Grinding Attachment may be used with either the No. 475 Plurality Oilstone Tool Grinder or with our older model No. 479. With it, planer, jointer, and similar knives up to 24 inches in length may be hollow ground to a perfect edge. With this attachment all the knives in the school shop (up to 24") may be maintained in excellent condition. The entire unit is self-contained and may be attached or dismounted quickly without the use of special tools.

Specifications

Capacity, Length of Knives.....24"
Will grind bevels....to 90°
Net Weight.....130 lbs.
Weight, Crated.....160 lbs.

Other machines such as Radial Grinders, Facing Heads and Oilstone Grinders of different design than those described here are manufactured by us. We will gladly send descriptive literature upon request.

Mummert-Dixon Co.
Hanover, Pennsylvania

Developing A General-Shop Course

Lester C. Smith

University High School, University of Chicago, Chicago, Illinois

To make the general shop interpret the industrial world, the teacher must go to industry to determine what is to be included in his course.

INDUSTRIAL ARTS has become the laboratory through which the power of doing things, as distinguished from thinking, talking, or writing about them, has been put to the test. In this type of work, the sciences, arts, and crafts may be dignified by careful scientific study and a new respect given to skill, ingenuity, and dexterity of labor. Admitting the universality of this subject, the next question is, "What shall we teach?"

The present trend seems to be toward the so-called general shop as opposed to the more or less special shops, like cabinetmaking, blacksmithing, carpentry, etc. There has been and is yet much discussion of what, when, and how to teach a general-shop course. Material available has sometimes determined what is taught, interest has been used as a criterion, whims and fancies or hobbies of instructors have often carried much weight, but seldom has a general plan of selection been followed. While the following proposal may not be the best plan, it is at least logical and seems to point to a method of selecting subject matter which may be followed in any community.

For this study the aims of the general shop are taken as follows:

1. To give direct experience and first-hand knowledge in the mechanical activities and devices of everyday life which make for social efficiency and economy and help to intelligently interpret the industrial world in which we live.

2. To develop in the student the power to do or accomplish things and to feel pride in such accomplishments.

3. To appreciate the work of others and to have a joy in their success.

If this work is to interpret the industrial world, it is to this same industrial world that one must look for the subject matter. If the student is to appreciate the work of others and show a respectful attitude toward their skill, he must know their problems, their difficulties and basic processes. It was for this purpose that a study of the male occupations of the United States was made from the data gathered from the 1920 United States census. From this study the following list of the one hundred most numerous occupations was made, the numbers being given in the thousands.

The next step was to pick out those occupations, the information about which could be taught in the school shop.

Farmers	5,947	Gardeners	160	Locomotive firemen	91
Farm laborers	3,248	Tailors	160	Mail carriers	90
Retail dealers	1,249	Agents	159	Builders and contractors	90
Miners	1,087	Bankers	156	Porters	87
Clerks (except store)	1,015	Lumber (semiskilled)	150	Policemen	81
Machinists	894	Janitors	149	Transportation foremen	79
Carpenters	887	Firemen (except fire department and locomotive)	143	Farm foremen	78
Salesmen	816			Shoemakers	78
Iron and steel (laborers)	717	Clothing (semiskilled)	143	Boilermakers	74
Iron and steel (semiskilled)	632	Food laborers	143	Apprentices to building	73
Building laborers	608	Real estate	139	Café keepers	73
Tramp laborers	541	Physicians	137	Wholesale dealers	72
Other laborers	426	Conductors	137	Clay and glass (semiskilled)	72
Road and steel transportation	421	Telegraph and telephone	136	Tin workers	71
Transportation (semiskilled)	410	Technical engineers	136	Locomotive motormen	66
Bookkeepers and cashiers	375	Brick and stone masons	131	Metal workers	62
Textile (semiskilled)	370	Textile (laborers)	131	Designers and draftsmen	62
Painters	319	Insurance	129	Cigar makers	61
Lumber and furniture laborers	309	Compositors and typesetters	128	Metal (semiskilled)	60
Chauffeurs	284	Garden (laborers)	127	Launderers	59
Mechanics	281	Clergymen	125	Musicians	57
Engineers (stationary)	279	Molders and casters	123	Filers, grinders, and polishers	57
Foremen and overseers	277	Teachers	122	Dentists	54
Servants	258	Lawyers	120	Fishermen	52
Clerks (store)	243	Clay, glass, and stone laborers	120	Fire department	50
Soldiers and sailors	225	Inspectors	117	Stenographers	50
Manufacturers	223	Food (semiskilled)	116	Cabinetmakers	49
Blacksmiths	221	Guards and watchmen	115	Paper laborers	49
Electricians	212	Brakemen	114	Plasterers	45
Plumbers	206	Waiters	112	Leather	41
Barbers	182	Locomotive engineers	109	Hotel keepers	41
Commercial travelers	176	Messengers	98	Garage keepers	41
Transportation (water)	171	Bakers	93	Printers	39
Deliverymen	170			Jewelers	37

This, of course, will vary according to the opinions of different people, but by sending the list to several instructors in different parts of the country and making several combinations which seemed wise in order to give more general occupations, the following list was selected:

Farmers	Lumber and furniture
Miners	Chauffeurs
Machinists	Mechanics
Carpenters	Engineers
Iron and steel trades	Manufacturers
Building and contractors	Blacksmiths
Bookkeepers	Electricians
Textile	Plumbers
Painters	Leather

(Continued on page 114)

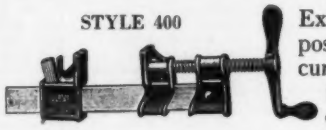
—NOW—

Together with Genuine

"Jorgensen" Handscrews,

favorably known in every shop, you will find it a big advantage to insist upon having the new Genuine "JORGENSEN" *Steel Bar Clamps!*

STYLE 400



Extremely fast and positive in action, secure in holding qualities, and easy to operate.

STYLE 430

Simple and rugged in design, strong, durable and very low in cost.

STYLE 450

You will miss an unusually good item if you fail to investigate these new "JORGENSEN" Steel Bar Clamps before buying further clamp equipment.

Ask for Free Copy of Our New Catalogue

Adjustable Clamp Co.

424 N. Ashland Ave. Chicago, Ill.

TEACH FURNITURE WEAVING

Reduce operating costs without impairing the practical value of manual training.

Furniture Weaving is entirely hand work and offers more real training value per dollar than any other medium devoted to the coordination of mind and muscle.

Only a few inexpensive household tools are required. An awl (ice pick), small hammer, wire cutter and finishing brush constitute the entire equipment. Expensive machinery and power bills are eliminated. All expense is for materials and they are more economical than ever before.

SEND FOR THIS 1933 CATALOG

Tells you all about Furniture Weaving and illustrates over one hundred practical projects your classes can make.

Address Department A

GRAND RAPIDS FIBRE CORD CO.

609 Myrtle Street Grand Rapids, Mich.

BOOKS FOR THE SCHOOL SHOP

Authoritative-Practical-Well Illustrated

The teaching material in these new books has been carefully edited and well illustrated by men especially trained for the work. Many leaders in Industrial Arts and Vocational Education have adopted these books as their School Shop texts.

Easy to Understand--Easy to Apply

We have over one hundred books for the school shop. A few of them are listed below. Each one is 5"x7½", leatherette, unless specified otherwise.

AUTOMOBILE

Automobile Carburetors	200 pp.,	77 illus.	$2.00
Automobile Electric Equipment (3 Vols.)	348 pp.,	158 illus.	3.75
Automobile Transmission	96 pp.,	47 illus.	1.00

BLUEPRINT READING

Reading Shop Blueprints, (2 Vols.)	200 pp.,	152 illus.	2.75
Reading Architects' Blueprints	174 pp.,	97 illus.	2.00

BUILDING TRADES AND WOODWORKING

Carpentry (3 Vols.)	427 pp.,	328 illus.	4.50
Carpentry Job Sheets	84 sheets (4 pp. each),	illus.	4.20
Painting and Wood Finishing	156 pp.,	90 illus.	1.75
The Steel Square	135 pp.,	105 illus.	1.50

DRAFTING AND SKETCHING

Machine Sketching	82 pp.,	83 illus.	1.00
Mechanical Drawing	114 pp.,	69 illus.	1.50

ELECTRICITY

Electrical Measuring Devices	101 pp.,	73 illus.	1.00
Interior Wiring, Electric Signals	155 pp.,	230 illus.	1.75

METAL WORK

Bench Work	104 pp.,	103 illus.	1.25
Green-Sand Molding	184 pp.,	157 illus.	1.75

PRINTING

Progressive Lessons in Printing, 40 lessons	134 pp.,	6"x9", 39 illus.,	1.50

VOCATIONAL GUIDANCE

Occupational Studies	Cloth,	6"x9", 81 pp.	$1.00
The Printing Trades and Their Workers, Cloth, 5"x8", 132 pp., 66 illus.			1.40
Vocations in Industry, (3 Vols.) Cloth, 826 pp., 279 illus.			7.00
Manual to Accompany Vocations in Industry, cloth, 6"x9", 120 pp.			2.00

Other Groups of texts include:—

Art, Illustrating and Designing (6"x9"), Advertising, Aviation, Commercial, Chemistry, Engineering, English, Gas Engines, Heating and Ventilation, Mathematics, Patternmaking, Plumbing, Radio, Refrigeration, Salesmanship, Sheet Metal, Show Card and Sign Lettering, Telephone and Telegraphy, Textiles (6"x9") and Welding. Most of these books are also in pamphlet form.

Catalog sent on request.

INTERNATIONAL TEXTBOOK CO.

INTERNATIONAL TEXTBOOK CO.
Box 8905-D, Scranton, Penna.

☐ Please send me on approval your texts on the following subjects:
☐ Please send me prices of your texts on the following subjects:

.....

.....

.....

I agree to return texts if not adopted or to remit for same.

NAME.....

POSITION.....

SCHOOL.....

ADDRESS.....

Automotive Equipment, Tools, and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	*No.*	*Name and Description*	*No.*
Air Compressor		*Creepers*	
3 to 4 cu. ft., with tank, piping, and motor		*Desk with Chair*	
Small portable, 1 cu. ft., with motor		*Drill*	
Aligning Jig, for connecting rods		Breast	
Anvil		Hand	
No. 100 or No. 125		Electric portable, ½-in.	
Rim		Electric portable, ¼-in.	
Armature Growler and Tester		Press, 21-in., with motor and chuck	
Axle Stands		*Dynamometer,* electric	
Battery Equipment		*Forge,* with blower and tools	
Cell tester, panel type with discharge rack		*Furnaces,* gas	
Charger (15-battery size) with rack		*Grease Dispensers*	
Charger (6-battery size)		*Grinder*	
Gas stove (small)		Cylinder with motor	
Lead-burning torches, with gauges and piping		8-in., with motor	
Plate racks		12-in., with motor	
Bench		*Hones,* cylinder	
Electric test, elaborate		*Jacks*	
Electric test, simple		Lever, 1½ ton	
Work, with vises		Floor, roller	
Work, portable with vise		*Lathe*	
Blackboard		11 in. by 4 ft. with motor, chucks, and attachments	
Blowtorches, 1 quart		16 in. by 6 ft. with motor, chucks, and attachments	
Bookcase		*Press*	
Brake		*Arbor*	
Adjusting stand		30 ton	
Band-lining machine		*Spray Painting Outfit*	
Bulletin Board		*Valve Refacing Machine*	
Cabinets		*Vulcanizer*	
Wood or metal, for bolts and supplies		Electric steam for tube work	
Wood or metal, for filing job sheets and correspondence		Small, hand	
Chain Hoist, with overhead trolley and track		*Welding Outfit,* with tanks, gauges, and cutting torch	
Chairs with Tablet Arms, or chairs for tables		*Wheel Alignment*	
Crane, portable		Gauge	
Crankshaft Truing Tool		Test table	

Small Tools

Name and Description	*No.*	*Name and Description*	*No.*	*Name and Description*	*No.*
Alcohol Tester		1-gal. gas safety		*Floor Brushes,* 18 in.	
Battery		5-gal. gas safety		*Funnels,* tin, assorted sizes	
Cell tester, prod type		5-gal. kerosene		*Gauges*	
Cell tester, cadmium		Waste can		Air pressure	
Clips, large		*Checks,* tool, 1,000 blank		Center	
Element pullers		*Chisels*		Depth	
Fillers		Cape, 3/8- and 5/8-in., each		Thread	
Funnels, glass		Cold, 3/8-, 5/8-, 3/4-, 1-in., each		Thickness	
Hydrometer, acid		Diamond point each		*Glass Cutters*	
Knives		*Combination Squares,* 12 in.		*Goggles*	
Post builders		*Cotter-Pin Extractor*		*Grease Guns,* plain and pressure-type, each	
Post drills		*Dividers,* 6 and 10 in., each		*Hammers*	
Post reamers		*Drill Sets*		Ball-peen, 4-oz.	
Post markers		1/32 to ½ in. by 64ths		Ball-peen, 1¼-lb.	
Separator trimmer		½ to 1¼ in. by 32nds		Ball-peen, 2-lb.	
Bits		*File Cards*		Lead	
Expansive		*File Handles,* assorted		Riveting	
Ratchet brace		*Files*		Sledge, No. 12	
Wood, 3/16 to 1 in., sets		Flat bastard, 6, 8, 10, and 12 in., each		*Ladle*	
Bolt Cutter		Half round, 6, 8, 10, and 12 in., each		3-in. bowl	
24 in.		Mill, 6, 8, 10, and 12 in., each		6-in. bowl	
36 in.		Round, 6, 8, 10, and 12 in., each		*Lamps,* extension, with reels	
Calipers		Square, 8, 10, and 12 in., each		*Lead Pot,* gas	
6 in., inside		*Fire Extinguishers,* Pyrene and Acid		*Magnet Charger*	
6 in., outside		*First-Aid Cabinet and Supplies*		*Meters,* volt and ammeter test, each	
Cans					
Oil, 1/3 pint					

(Continued on page 108)

Snap-on Tools, Inc.

Kenosha, Wisconsin

Sales Branches and Warehouses in 32 Principal Cities—Over 350 Salesmen

Genuine Snap-On Wrenches and Blue-Point Tools can be purchased only through our own Sales Branches listed. Advise your Purchasing Department accordingly.

Albany, N. Y..... 102 Quail St.
Atlanta, Ga..... 79 Edgewood Ave.
Baltimore, Md..... 2218 Greenmount Ave.
Boston, Mass..... 510 Cambridge St., Allston Dist.
Brooklyn, N. Y..... 1649 Bedford Ave.
Buffalo, N. Y..... 952 W. Ferry St.
Chicago, Ill..... 2025 Michigan Blvd.
Cincinnati, Ohio..... 2166 Gilbert Ave.
Cleveland, Ohio..... 2438 Euclid Ave.
Columbus, Ohio..... 107 N. Monroe Ave.
Dallas, Texas..... 2009-11 Main St.
Denver, Colo..... 17 E. Fourth Ave.
Detroit, Mich..... 4450 John "R" St.
Indianapolis, Ind..... 933 N. Illinois St.
Jacksonville, Fla..... 119 W. Ashley St.
Kansas City, Mo..... 2526 Grand Ave.

Snap-On has available a special Professional School Service by which expert mechanics are available to demonstrate, to any school requesting such service, the latest commercial garage repair methods.

Los Angeles, Calif.... 1845 S. Flower St.
Milwaukee, Wis..... 2417 W. State St.
Minneapolis, Minn.... 1218 Harmon Place
Montreal, Que..... 1008 La Gauchetiere St., W.
Newark, N. J..... 429 Central Ave.
New York, N. Y..... 2721 Webster Ave.
Omaha, Neb..... 2951 Harney St.
Philadelphia, Pa..... 1705 Fairmount Ave.
Pittsburgh, Pa..... 7250 Kelly Blvd.
Richmond, Va..... 603 W. Broad St.
San Francisco, Calif.. 276 Golden Gate Ave.
Seattle, Wash..... 301 E. Pine St.
St. Louis, Mo..... 2647 Washington Blvd.
Syracuse, N. Y..... 111 W. Taylor St.
Toledo, Ohio..... 1012 Jackson St.
Toronto, Ont..... 54 Dundas St., West
Vancouver, B. C..... 1209 Burrard St.

Expert Department, Snap-On Tools, Inc.,
59-61 Pearl St., New York, N. Y.

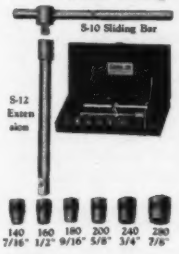
Snap-On Socket Wrenches

Snap-on INTERCHANGEABLE **Socket Wrenches**

Snap-On Wrenches are used and recommended by more good mechanics in America than any other tools of their kind. The line consists of a complete range of dependable wrench sockets which are made to interchange on the various wrench handles and attachments. Any required type of socket wrench to fit hexagon and square nuts and cap screws of all sizes is thus provided at a very low cost per wrench.

We maintain a nation-wide tool service direct from factory to all wrench users throughout industry, with over 350 salesmen. The salesman who calls in your city will be glad to furnish any desired information concerning the application of Snap-On and Blue-Point tools in the school auto mechanics shop. Our Experimental Engineering Department is constantly developing new tools to meet changing requirements and our salesmen are always in possession of valuable information along service lines.

The Snap-On School Shop Student Set



Snap-On School Shop Student Set consists of a combination offset and sliding tee handle, and the six most needed sizes of sockets. These units interchange to give thirty practical wrench combinations. School Auto Shop Instructors have approved and considered this combination as solving a very perplexing and otherwise costly problem.

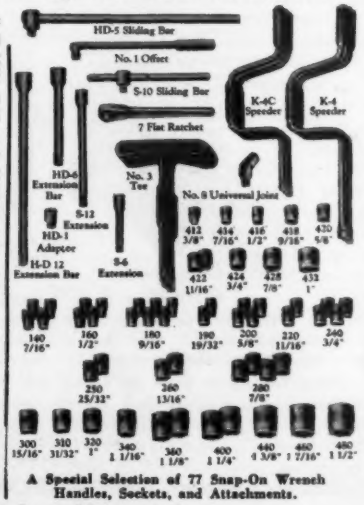
8 Snap-On Wrenches as illustrated, in metal case.....$5.30

Special School Price, when sold in lots of six or more sets and for educational purposes only, each.....$4.00

Snap-On School Shop Toolroom Assortment

These tools were carefully selected as forming the socket wrench equipment of greatest service in the average school auto mechanics shop. Duplication is made of units used most often. The set will be found particularly attractive when tools are checked in and out of the toolroom. Additional units can be added as required. Complete descriptions of the wrenches are given in our new 1933 catalog.

77 Snap-On Wrenches, as illustrated, with individual prices totaling $54.80



A Special Selection of 77 Snap-On Wrench Handles, Sockets, and Attachments.

Special School Price *(when sold as a set)* for educational purposes only.....$41.00

NOTE: Snap-On School Shop Toolroom Assortments are not limited to the one illustrated. Other selections of handles and sockets can be made up according to your specifications as desired.

Blue-Point Tools

Blue-Point Mechanic Tools

Blue-Point Boxocket Wrenches, Open End and Tappet Wrenches, Punches, Chisels, Screw Drivers, and other hand tools are comparable to Snap-On in quality and service. Their wide popularity in the industry is the highest possible recommendation for them. We can best refer you to our new 1933 catalog for details and specifications of these tools which have gained for them undisputed leadership in the field. With the tools we offer a plan of supply and of service which we believe supervisors and instructors will consider as being of very real and definite value.

Tool Budget Plan

With the information obtained through a very careful survey of the needs of the school shop the following 14 distinct tool budgets, ranging in price from $25.00 to $250.00, were prepared. They provide supervisors and instructors with an easy, accurate method of purchase. Each budget contains the most useful selection of quality tools obtainable for any given amount of money available at any one time. The Snap-On interchangeable feature enables you to start with a small set of handles and sockets and keep adding new units as needed. The fact that tools other than socket wrenches are also available enables you to have in your school shop a uniform outfit, made by one factory, always up-to-date, guaranteed as to quality, and backed by a periodic inspection service.

SW-1200 Set, Extra Thin, Straight Walled Hexagon Sockets. Double broached. 7/16" to 1" openings. The most popular sockets today with garage mechanics everywhere.

Budget No. 1—$25.00

Provides wrench equipment enabling a small class to work comfortably. Contains the most necessary Snap-On socket wrenches and Blue-Point Open End, Tappet and Adjustable Wrenches.

Budget No. 1, Regular Price.....$33.65

Special School Price *(when sold as a set)* for educational purposes only.....$25.00

No. 25 Nut Spinner Set. Covers more jobs for its size than any other socket set made.

Vacuum Grip Pliers. Recognized by professional mechanics as a true quality line, and known everywhere for their strength and durability. Made in all styles.

No. 8 Universal Joint. Fits all master handles to make a flex wrench of every socket.

Master Flex Socket—made in 5 popular sizes.

Crank Case Drain Plug Socket—Made in 8 sizes.

No. 310 Feeler Gauge. Finest Swedish steel.

Snap-On Tools, Inc., Kenosha, Wisconsin — Continued on page 109

(Continued from page 106)

Name and Description	*No.*	*Name and Description*	*No.*	*Name and Description*	*No.*
Micrometers		Taper pin		*Tap-and-Die Sets*	
Outside, 0 to 1 in.		Valve seat, sets		Machine screw	
Outside, 2 to 3 in.		*Saws*		S.A.E. ¼ to 1 in.	
Outside, 3 to 4 in.		Hack, frames, 10-in., adjustable		U.S.S. ¼ to 1 in.	
Inside, 1½ to 6 in.		Hack-saw blades, 18-, 20-, and 24-teeth		*Tire Tools*, sets	
Molds		Hand		*Tool Kit*, metal box or canvas roll, empty	
Battery nut		*Scales*		*Twist Drills* (extra sets), selected sizes	
Battery post		Steel, 6-in., graduated 1/64 and 1/100 in		*Valve*	
Battery strap		Steel, 12 in., graduated 1/32 in.		Grinders (hand)	
Burning stick		*Scrapers*		Spring lifters	
Lead hammer		Bearing, sets		*Wrenches*	
Oilstone		Carbon, sets		Adjustable, 18-in.	
Pipe Taps, ⅛, ¼, ⅜, and ½ in.		*Screw Drivers*		Adjustable, 12-in.	
Pliers		6 in.		Adjustable, 10-in.	
Combination, 6 in.		12 in.		Adjustable, 8-in.	
Flat nose		Small Combination		Ignition sets	
Round nose		*Screw Extractors*, sets		Pipe, 10-, 14-, 16-, and 18-in., each	
Pullers		*Scribers*		Rim socket	
Bearing		*Snips*, tin, 3-in. straight and 3-in. curved, each		Socket sets, large assortment with case	
Gear		*Soldering Coppers*, 1-, 2-, and 3-lb. with handles, sets		Spark plug	
Wheel, hub type		*Spring Spreaders*		Speed wrenches	
Punches		*Stamps*		Standard end sets, ¼ in. to ⅞ in., U.S.S. and S.A.E.	
Center (sets)		Figures, 3/16-in., set		Valve-tappet wrenches, sets	
Taper pin (sets)		Letters, 3/16-in., set			
Blacksmith (sets)					
Putty Knives					
Reamer, spindle bolt					
Reamer Sets					
Piston pin, ½ to 1⅜ in.					

Supplies

Name and Description	No.	*Name and Description*	No.
Acetylene Gas, in drums, for welding		Machine-screw, selected sizes, in lots of 100 each	
Acid		Wing, selected sizes, in lots of 100 each	
Alcohol, gal.		*Oil*	
Babbitt, lb.		Cylinder, light, medium, and heavy	
Bearing Blue, tubes		600W	
Bearing Compound, cans		Penetrating, pints	
Bolts		*Oxygen* in drums for lead burning	
Machine, selected sizes, lots of 100 each		*Pig Lead*, lb.	
S.A.E., selected sizes, lots of 100 each		*Piston-Ring Compressors*	
Stove, flat or round heads, selected sizes, in lots of 100 each		*Radiator Hose*	
Brake Juice, ½-pt. cans		*Rivets*, brake-lining, 5/16, ½, and ¾ in long. Boxes of 100, each	
Brushes		*Sandpaper*, Nos. 00, 0, ½, and 1, quires each	
Paint		*Screws*	
Spark-plug		Flat-head or round-head, iron or brass. Selected sizes and kinds, per gross, each	
Spoke		Cap and machine, iron or brass. Selected sizes and kinds, lots of 100 each	
Steel		*Sealing Compound*	
Varnish		*Shellac*, ½-pt. cans	
Chamois		*Shim Stock*	
Coil-Spring Assortment		*Soapstone*, lb.	
Copper Tubing		*Solder*, bar, wire, or self-fluxing wire	
Cotter Pins, assorted sizes, pkgs.		*Soldering Paste*	
Crocus Cloth, quires		*Spelter*, for brazing, lb.	
Distilled Water, gal.		*Sponges*, ½-lb. each	
Drain Cocks		*Starting Cable*, ft.	
Electrolyte, carboy		*Tacks and Staples*, for upholstery	
Emery Cloth, Nos. 00, 0, ½, and 1, quires each		*Tire*	
Enamel for Auto Painting		Carcass fabric	
Gaskets		Cushion stock	
Copper asbestos		Inner-tube repair stock	
Cork and felt		Patching cement	
Flange		Patches	
Gasoline		Putty	
Grease, cup, cans		Tread stock	
Kerosene		Vulcanizing	
Keys, Whitney, assorted		*Valve-Grinding Compound*, coarse and fine, 8-oz. cans	
Lacquer, colors, qt.		*Washers*	
Lead		Lock, assorted sizes	
Lubricant, transmission		Wrought iron	
Nails and Brads		*Waste*, lb.	
Nuts		*Wire*	
S.A.E., castellated, square, hexagon. Selected sizes and kinds, lots of 100 each		Primary, ft.	
U.S.S., square and hexagon. Selected sizes, lots of 100 each		Secondary, ft.	

Snap-on Tools, Inc., Continued from Page 107

Budget No. 2—$50.00

This tool equipment is based on the School Shop Toolroom Set illustrated on opposite page, with the addition of some of the most necessary Blue-Point tools.

Alternative Budget No. 2-A—$50.00

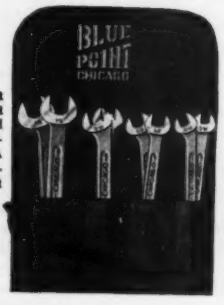
This budget offers in place of the more complete socket wrench equipment, a varied selection of other important tools, including our remarkable new Blue-Point Wheel Puller.

Budgets 2 and 2A, Regular Price.....$65.90

Special School Price *(when sold as a set)* for educational purposes only.....$50.00

Special Brake Wrench from No. 5200 Set. Adapted to Bendix and Lockheed brakes. Made in 6 needed sizes.

BT-8K Tappet Wrench Set at right. Preferred by good mechanics everywhere. A practical assortment of most popular sizes.



Blue Point Open End Wrench Set No. BPR-8—Eight wrenches for popular S. A. E. sizes from ¼" to ⅞" thread diameters.

Budget No. 3—$75.00

This budget equips twelve students with the individual Students' Sets and provides additional tools necessary for efficient auto repair service.

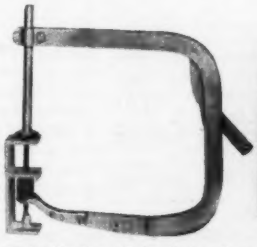
Alternative Budget No. 3-A—$75.00

Using the School Shop Toolroom Set as the basis, we add a set of Ferret socket wrenches for easy work in close quarters. Together with a good assortment of other tools, this budget provides an excellent layout for a class of twelve or more pupils.

Budgets 3 and 3-A, Regular Price.....$100.35

Special School Price *(when sold as a set)* for educational purposes only.....$75.00

Snap-On Tydeman Hone. Rapidly replacing reaming outfits for fitting piston pins and other small bearings. A real precision tool with micrometer adjustment which lets you know just how much stock you are cutting away. The cost of grinding sheets is less than sharpening reamers. Cuts uniformly in iron, bronze and lyanite, and is very efficient in hardened steel bearings.



CF-1 Blue-Point Valve Spring Compressor—Stronger, Slim, Channel-Formed, Adjustable Jaws for all types of motors. Convenient to use, cam-lock holds spring where desired. Adjustments easily made, especially efficient when used with CF-2 Key Replacer and CF-3 Key Catcher illustrated below. These tools save valuable time and eliminate need for "ragging up" the motor.

Budget No. 4—$100.00

This budget is based on eighteen students and primarily suggests the individual Students' Sets. Other tools that are very necessary in the auto shop are also included.

Alternative Budget No. 4-A—$100.00

This equipment is based on the School Shop Toolroom set together with the most popular of our Blue-Point items.

Budgets 4 and 4-A, Regular Price.....$133.45

Special School Price *(when sold as a set)* for educational purposes only.....$100.00

Budget No. 5—$125.00

For an extensive course for twelve to fifteen students. Based on the School Toolroom Set with the addition of the Ferret set and Blue-Point tools.

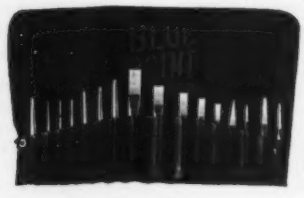
Alternative Budget No. 5-A—$125.00

Based on the School Shop Student's Set and including widely used Blue-Point units.

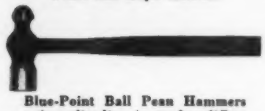
Budgets 5 and 5-A, Regular Price $166.55

Special School Price *(when sold as a set)* for educational purposes only..... .....$125.00

The new No. 200 Blue-Point Universal Wheel Puller with interchangeable collets to cover practically all makes of cars, new and old models. Nothing to assemble or adjust. Makes wheel pulling easy. At right—Snap-On Wheel Puller, an improved and exceptionally efficient type of knock-off wheel puller. 5 sizes. A new type of improved Gear Puller is also available. See 1933 catalog.



No. SR-16 Set Blue-Point Pin Punches, Center Punch, Flat Chisels, Diamond Point and Cape Chisels.



Blue-Point Ball Peen Hammers—A quality line in twelve different weights from 2 oz. to 3 lbs.

Budget No. 6—$150.00

This Budget is based on the requirements of twenty students in a shop with a wide project range.

Alternative Budget No. 6-A—$150.00

Based on the School Shop Students' Set and is a very complete set of Snap-On Blue-Point units, sufficient to properly and individually equip a class of 20 students.

Budgets 6 and 6-A, Regular Price $200.75

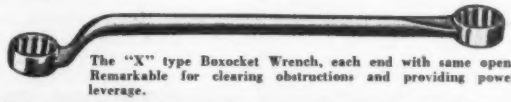
Special School Price *(when sold as a set)* for educational purposes only..... .....$150.00

Blue-Point Insuloid Screw Drivers designed to stand up under the hardest service. Handles are a new composition—a non-conductor of electricity—practically indestructible. Blades of electric furnace alloy tool steel, carefully hardened and heat-treated. Other types available.

Budget No. 7—$250.00

This selection is designed to meet every situation calling for the use of a socket wrench. The Blue-Point tools included are as complete an assortment of hand tools as we believe necessary for the school shop.

At right is a Dwarf Boxocket Wrench from the XS-5 Set. Very small design, each end with different opening. Great for carburetor, generator, universal joint, and other work in tight places.



The "X" type Boxocket Wrench, each end with same opening. Remarkable for clearing obstructions and providing powerful leverage.

Showing style of our "XD" line of double end Boxockets. Heads set at a 15 degree angle. Long leverage and easy to use around obstructions. Made in a wide range of sizes. Each wrench with 2 different openings.

Alternative Budget No. 7-A—$250.00

For those who find the School Shop Toolroom Set a more practical basis for socket wrench equipment, this budget has the advantages of a somewhat greater variety of other tools than are offered in Budget No. 7.

Budgets 7 and 7-A, Regular Price.....$333.45

Special School Price *(when sold as a set)* for educational purposes only.....$250.00

All tools listed in the budgets are fully described in our new 1933 catalog. You need this catalog when studying budgets.

WRITE FOR 1933 CATALOG AND DETAILED BUDGETS

Contains complete Snap-On and Blue-Point lines, including newest developments. Catalog page numbers are given in budgets for easy reference.

Snap-On Tools, Inc., Kenosha, Wisconsin

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.	Name and Description	No.
Bench Grinder		**Coil**		**Pliers**	
Benches		Spreader		Gas, 6½"	
Plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets		Taper		Gas, 8"	
Bits		Winder		Side-cutting, 6"	
Auger, ¼" to 1" by 16ths, each		**Desk**		**Punches,** assorted, sets	
Auger, $\frac{11}{16}$", 18" long		Teacher's, with drawer compartments		**Punch,** for metal molding	
Drill, for wood, square shank, ⅛" to ½", by 16ths, each		Chair, to match desk		**Reamers**	
Expansion		**Drill**		Pipe burring, ¼" to 1"	
Extensions, 18"		Breast		Pipe burring, ½" to 2"	
Screw-driver, ¼"		Concrete, ⅜", ½", ¾", 1", each		**Rules**	
Blackboard		Hand		48" zigzag	
Permanent or portable		Portable Electric		72" zigzag	
Blowtorches, 1-qt. size		Twist, $\frac{3}{32}$" to ⅜" by 32nds, each		**Screw Drivers**	
Bookcase		**Drill Press**		3"	
For reference books, catalogs, etc.		Bench, hand or power driven		5"	
Braces, ratchet-type, 8" swing		Heavy, power driven		8"	
Bulletin Board		**Files**		**Shears,** for cutting metal molding	
Cabinets		**First-Aid Cabinet and Supplies**		**Soldering Coppers,** assorted	
Wood or metal, for filing class records, instruction sheets, drawings, etc		**Hack Saw**		**Soldering Copper,** electric	
Chairs		Blades, 10", 24 teeth per inch. Gross		**Soldering-Copper Handles**	
Tablet-arm chairs		Frames, adjustable		**Solder Dippers**	
Compass Saw		**Hammers**		**Stocks and Dies,** for pipe threads, ½" to 1"	
		Claw, 12 oz		**Vises**	
		Machinists', ball-peen		Machinists', 4"	
		Hickey, ½" and ¾", each		Pipe	
		Lathe		**Wrenches**	
		Engine, 10" or 12" swing, 6' or 8' long		Adjustable, 6"	
		Speed		Adjustable, 8"	
				Pipe, 10", 12", and 14", each	
				Socket, combination, sets	

ELECTRICAL SHOP—SUPPLIES

Name and Description	No.	Name and Description	No.	Name and Description	No.
Armored Cable		Couplings, for flexible		white pine, dressed 4 sides, pc.	
2-wire, No. 14, single-strip, ft.		Lock nuts, ½", ¾", and 1" each		**Molding**	
3-wire, No. 14, single-strip, ft.		Rigid, ½", ¾", and 1", ft. each		Metal, ft.	
Box connectors		**Condulet**		Metal, fittings—crosses, tees, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches. Each	
Attachment Plug		Fillings, ½", LL, LR, and LB, each		Wood, 2-wire, with capping, ft.	
Battery Acid, 1.300 carboy		Covers, ½", blank		Wood, 3-wire, with capping, ft.	
Batteries, dry cells		**Door Openers,** mortised		**Nails,** roofing, lb	
Battery-Sealing Compound, lb.		**Emery Cloth,** 1½" wide, rolls		**Nuts,** iron, 4-36, 6-32, 8-32, 10-24, 12-24, 10-32, 14-20, gross each	
Bar Hangers		**Fixtures,** brass-chain, suspension		**Outlet Boxes,** 4" square, with one round blank cover, and one cover with bushed opening, each	
Box Cleats		**Fixture Studs**		**Pipe Straps,** galvanized, ⅜", ½", ¾", and 1". lb. each	
Brads, ¾", No. 19, and 1½", No. 16, lb. each		**Fish Paper,** .0125" thick, sq. yd.		**Push Buttons**	
Brake Lining, ¼"x 2" ft.		**Fuses**		Return-call, 3-point	
Brushes, carbon, for motors and generators		Plug-type, renewable, 125-volt, 15 amp		Single-piece	
Burglar Contacts		Cartridge-type, renewable, 125-volt, 30 amp		**Receptacles**	
Open-circuit		Renewals for plug fuses		Flush, duplex	
Closed-circuit		Renewals for cartridge fuses		Porcelain - cleat, 660 - watt, 250-volt	
Bushings		**Ground Clamps,** ⅜" to 1", assorted		Concealed	
Loom, No. 1 and No. 2, each		**Hickey Grips,** ½" and ¾", each		Covers	
"Jiffy" loom No. 2		**Lamps**		**Resistance Units,** 125-ohm	
Buzzers		Carbon, 220-volt, 60 watt		**Rosettes,** wood	
Cleats, unglazed porcelain, 2-wire		Mazda, 10-watt, type B, 120-volt			
Clips, test, with insulators, Universal, Nos. 22, 23, 24, and 25. Each		Guards, for brass sockets			
Commutator Cement, cans		**Leather Nail Heads**			
Conduit		**Lugs,** 25 and 50 amp			
Bushings, ½", ¾", and 1", each		**Lumber,** 2"x 4"x 14', No. 1,			
Box connectors, for flexible.					

(Continued on page 112)

General Electric Company

General Offices: Schenectady, N. Y.

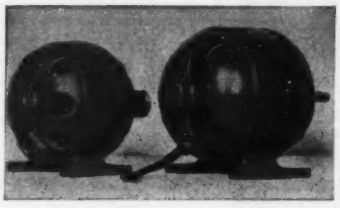
Sales Offices: Address Nearest Office

Akron, Ohio, 106 S. Main St.
Atlanta, Ga., 187 Spring St., N.W.
Baltimore, Md., 39 W. Lexington St.
Binghamton, N. Y., 19 Chenango St.
Birmingham, Ala., 600 No. 18th St.
Boston, Mass., 140 Federal St.
Buffalo, N. Y., 1 W. Genesee St.
Butte, Mont., 20 W. Granite St.
Canton, Ohio, 700 Tuscarawas St., W.
Cedar Rapids, Iowa, 203 Second St., S.E.
Charleston, W. Va., 304 Capitol St.
Charlotte, N. C., 200 S. Tryon St.
Chicago, Ill., 230 S. Clark St.
Cincinnati, Ohio, 215 W. Third St.
Cleveland, Ohio, 925 Euclid Ave.
Columbus, Ohio, 17 S. High St.
Dallas, Tex., 1801 N. Lamar St.
Davenport, Ia., 511 Pershing Ave.
Dayton, Ohio, 25 N. Main St.
Denver, Colo., 650 Seventeenth St.
Des Moines, Ia., 418 W. Sixth Ave.
Detroit, Mich., 700 Antoinette St.
Duluth, Minn., 14 W. Superior St.
El Paso, Tex., 109 N. Oregon St.
Erie, Pa., 10 E. Twelfth St.
Fort Wayne, Ind., 1635 Broadway
Fort Worth, Tex., 408 W. Seventh St.
Grand Rapids, Mich., 148 Monroe Ave., N.W.
Hartford, Conn., 18 Asylum St.
Houston, Tex., 1016 Walker Ave.
Indianapolis, Ind., 110 N. Illinois St.
Jackson, Mich., 212 Michigan Ave., W.
Jacksonville, Fla., 700 E. Union St.
Kansas City, Mo., 106 West 14th St.
Knoxville, Tenn., 602 S. Gay St.
Los Angeles, Calif., 5201 Santa Fe Ave.
Louisville, Ky., 455 S. Fourth St.
Memphis, Tenn., 8 N. Third St.
Milwaukee, Wis., 940 W. St. Paul Ave.
Minneapolis, Minn., 107 S. Fifth St.
Nashville, Tenn., 234 Third Ave., N.
Newark, N. J., 744 Broad St.
New Haven, Conn., 129 Church St.
New Orleans, La., 837 Gravier St.
New York, N. Y., 120 Broadway
Niagara Falls, N. Y., 201 Falls St.
Oklahoma City, Okla., 119 N. Robinson St.
Omaha, Nebr., 409 S. Seventeenth St.
Philadelphia, Pa., 1405 Locust St.
Phoenix, Ariz., 441 W. Madison St.
Pine Bluff, Ark., 501 Main St.
Pittsburgh, Pa., 535 Smithfield St.
Portland, Ore., 329 Alder St.
Providence, R. I., 76 Westminster St.
Richmond, Va., 700 E. Franklin St.
Roanoke, Va., 202 S. Jefferson St.
Rochester, N. Y., 89 East Ave.
St. Louis, Mo., 112 N. Fourth St.
Salt Lake City, Utah, 200 S. Main St.
San Antonio, Tex., 201 Villita St.
San Francisco, Calif., 235 Montgomery St.
Schenectady, N. Y., 1 River Rd.
Seattle, Wash., 821 Second Ave.
Spokane, Wash., 421 Riverside Ave.
Springfield, Ill., 607 E. Adams St.
Springfield, Mass., 1387 Main St.
Syracuse, N. Y., 113 S. Salina St.
Tacoma, Wash., 1019 Pacific Ave.
Toledo, Ohio, 405 Madison Ave.
Trenton, N. J., 143 East State St.
Tulsa, Okla., 409 S. Boston St.
Utica, N. Y., 258 Genesee St.
Washington, D. C., 806 Fifteenth St., N.W.
Waterbury, Conn., 195 Grand St.
Worcester, Mass., 340 Main St.
Youngstown, Ohio, 25 E. Boardman St.

Canada: Canadian General Electric Company, Ltd., Toronto
Hawaii: W. A. Ramsay, Ltd., Honolulu
Motor Dealers and Lamp Agencies in all large cities and towns

Shop Projects

The General Electric Company, in carrying out its elaborate educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop due to the fact that they are not merely assembly projects but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The projects already issued and available without charge cover:



Educational Projects.
¼ H.P. and ¾ H.P. Motors.

1) ¼ H.P. Single-Phase, 60 cycle, 110 volt motor Bulletin GED-379
2) ¾ H.P. 3-Phase, 60 cycle, 110 volt motor Bulletin GED-534
3) ½ kw. 220–110/55 volt, single-phase, air-cooled transformer Bulletin GET-128

Kits for these projects can be purchased from the General Electric Company. In addition, complete instructions are given for the securing of any equipment that may not be included in the kit. Address your request to the Educational Specialist at the nearest General Electric Sales Office.

G-E Educational Service

The General Electric Company is deeply interested in education, as it recognizes that the future welfare of industry, and of the country as a whole, depends upon how well the students of today are trained for the work of tomorrow. It is the policy of the Company to aid the faculty and students of our schools and colleges in every way possible. To this end, Company publications, motion-picture films, illustrated lectures, etc., are made generally available without charge.

General Electric engineers will be glad to recommend apparatus to meet your special conditions if you will give them details such as: Type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company.

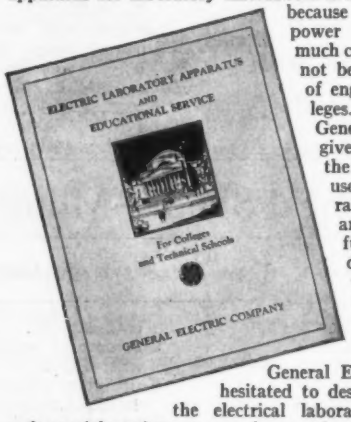
Illustrated Lecture Service

General Electric Motion Picture and Illustrated Lecture Service is available without charge to educational institutions. These lectures are particularly valuable to schools and colleges, as they enable the student and teacher to keep informed on all important developments in the electrical field.

Complete information on this service is available in publication GES-402B.

Shop Equipment

In general the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.



Where standard apparatus is not suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop. Among such special equipment may be mentioned the switchboards both for engineering and physics laboratories, special industrial control panels for A-C. and D-C. service, the AHI synchronous motor (or generator), and the 5 kw. rotary converter.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185A, which has been recently revised, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Selection of Equipment for Electrical Shop and Laboratory

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62A will be particularly useful. In this booklet will be found listed in six different groups, equipment to meet a wide range of requirements. For the elementary courses a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well balanced laboratory equipment which will permit a particularly wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Electrical Shop Layout

Where special conditions make standard laboratory or shop layouts unsuitable, General Electric engineers will be pleased to prepare for you without charge a laboratory or shop layout that will insure the most economical use of space and money. If you have any special electrical problems you are invited to consult with our engineers.

(Continued from page 110)

Name and Description	No.	Name and Description	No.	Name and Description	No.
Screws		**Solder Wire,** 50/50, size No. 10, lb.		Rubber, ½-lb. rolls	
Anchors, 8/32, 10/24, 12/24, 14/20, each		**Soldering Paste,** 2-oz. cans, noncorrosive		**Tubes**	
Machine, round-head, ¼", 4-36; ½", 6-32; ¾", 6-32; ⅜", 8-32; ½", 8-32; 1", 8-32; ⅜", 10-32; ⅜", 10-24; ¾", 10-24; ¾", 10-32; 1", 12-24; gross each size		**Soldering Salts,** 1-oz. cans, noncorrosive		Porcelain, $\frac{5}{16}$"x 3"	
Machine, brass, round-head, ¼", 4-36; ½", 6-32; ¾", 6-32; ½", 8-32; gross each size		**Split Knobs,** porcelain		Porcelain, $\frac{5}{16}$"x 5"	
Wood, flat-head bright, ¾" No. 5, ½" No. 8, ¾" No. 8, 1" No. 7, 1½" No. 8, 1½" No. 10, 2" No. 7, gross each size		**Switch**		Porcelain, $\frac{5}{16}$"x 10"	
Wood, round-head blued, 1" No. 7, 1½" No. 8, 1½" No. 10, 2" No. 7, gross each size		Battery, 4-point		**Tubing**	
Sleeving, No. 1, white, No. 1, blue, and No. 1, red. Spools each		Bases, porcelain for 10-amp. switches,		Flexible nonmetallic, ¼", ft.	
Sockets, brushed brass		Boxes, 2¾" deep		Flexible nonmetallic, ⅜", ft.	
Pull-chain		Entrance, safety, 2-pole, 30-amp., with 2-branch lighting circuits		**Washers**	
Keyless		Entrance, safety, 3-pole, 30-amp., 250-volt		Iron, ¼" and ⅜", lb. each	
Key		Flush, push-button, S.P., D.P., 3-way, 4-way, each		Brass, ¼" and ⅜", lb. each	
Socket Caps, ¼" brushed, ⅜" bushed, each		Surface, S1		**Wire**	
Porcelain keyless, with caps		Surface, S3		Annunciator No. 18 or No. 20, lb	
		Surface, S4		Fixture, No. 18, single yellow, with marker, ft	
		Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T., each		Fixture, No. 18, single yellow, with marker, ft	
		Surface, snap, electrolier		Rubber covered, solid copper, No. 10, black, ft	
		Surface, snap, S.P.D.P., 3-way, 4-way, each		No. 10, white, ft	
		Tacks, double-pointed No. 10, lb		No. 14, black, ft	
		Tape		No. 14, white, ft	
		Friction, ½-lb. rolls		Rubber covered, No. 16, brewery cord, ft	
				No. 18, lamp cord, green and yellow, ft	
				S.C.C. copper magnet, enameled, sizes, Nos. 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, lb., each	

Electrical Shop—Motor and Testing Equipment

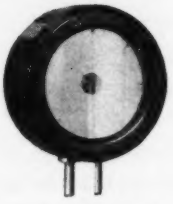
Name and Description	No.	Name and Description	No.	Name and Description	No.
Annunciators		volt, a.c.		ing from 1 to 12, 6- and 12-volt batteries	
Automatic needle-drop		Voltmeter, standard, 125-volt, d.c.		**Relays,** Dixie	
Gravity-drop		Voltmeter, student, 110-volt, d.c.		**Resistance Boards,** for testing.	
Manual needle-drop		Voltmeter, student, 110-volt, a.c.		**Rheostats**	
Armatures, burnt-out, for repairing		Wattmeter, standard, 110-220-volt, 30-60-amp., d.c.-a.c.		Compression, 275-watt	
Battery Charger, commercial.		Wattmeter, student, 110-220-volt, 30-amp., a.c.-d.c.		Field, for shunt and compound motors	
Circuit Breakers		Watt-hour Meter, 125-volt, 5 amp., a.c., single-phase, various makes		**Rotary Converter,** 5-kw. capacity, 3-phase, a.c., 110-volt d.c.	
Air, single-pole, overload, 25-amp., 550-volt		**Motors**		**Speed Counters,** 0-9999	
Air, single-pole, underload, 15-amp., 550-volt		Auto starter, different makes		**Spring Balances,** 0-30 lb	
Controllers		Burnt-out, fractional h.p., 110-volt, 60 cycle, for repairing		**Starting Boxes**	
For multiple-speed motor		Compound, 1 h.p., 110-volt, d.c.		For compound motors, various makes	
For 1-h.p., 110-volt series motors		Multiple-speed, 1 h.p., 3-phase, 220-volt		For shunt-wound, 1 h.p., 110-volt motors. Overload release	
Generators		Series, 1 h.p., 110-volt, d.c.		For shunt-wound, 1 h.p., 110-volt motors. No voltage release	
Motor-generator set, 10-h.p., to supply 110-volt d.c., for testing purposes, battery charging, etc.		Shunt, 1-h.p., 110-volt, d.c.		Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt, a.c. motors	
Generator, 6-volt d.c., coupled to an a.c. motor, for 6-volt circuit testing		Split-phase and repulsive, a.c., 110-volt, single-phase, assorted		**Storage batteries,** 6-volt	
Auto generators of different makes		Split-phase induction motors, fractional h.p., 110-volt, 60-cycle, different makes		**Switchboard,** as required	
Gravity Cells		3-phase, 1 h.p., a.c., 220-volt, various makes		**Telegraph Sets,** including sounders, keys, and relays, each	
Magnets, testing, 10,000-ohm		3-phase, 2 h.p., 220-volt, a.c., various makes		**Telephones**	
Meters		Universal, fractional h.p., 110-volt, different makes		Complete bridging, independent phones	
Ammeter, standard, 60-amp., a.c.		Universal, variable-speed, ½ h.p.		Couch vestibule telephones	
Ammeter, standard, 60-amp., d.c.		**Platform Scale,** 100-lb. capacity		Receivers, transmitters, induction coils, condensers, and bridging switch hooks, each	
Ammeter, student, 60-amp., a.c.		**Rectifiers,** Tungars, for charg-		**Transformers**	
Ammeter, student, 60-amp., d.c.				Bell-ringing, 6-8-14-volt	
Voltmeter, standard, 0-10-volt, d.c.				Single-phase, 110-220-volt, S. K.V.A.	
Voltmeter, standard, 110-220-volt, d.c.-a.c.					
Voltmeter, standard, 125-					

TRAIN THE YOUNGER GENERATION IN PRECISION . . .

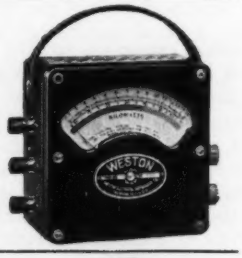
. . . . . *with "the world's standards of accuracy"*

Foot-Candle Meter — Model 614 measures light intensities directly in foot-candles. Completely self-contained. Easy to use as a Voltmeter. "Human-error" eliminated. A practical instrument for schools.

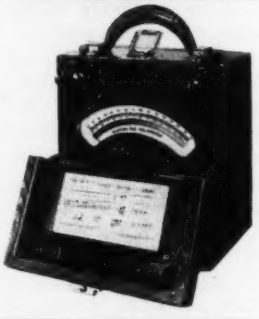
Photronic Cell — Model 594, dry type — simple in design — a marked advance in light sensitive cells. Current output about 1.4 microamperes per foot-candle. Unlimited life. Uses no battery, no amplifier.



"Junior" Line — Portable A.C. Ammeters and Voltmeters for general testing on commercial frequencies. Movable iron type. Accuracy within ½ of 1%.



Model 45 — Portable D.C. Ammeters and Voltmeters. Permanent magnet movable coil type, for general testing. Shielded from the effects of external magnetic fields. Accuracy within ½ of 1%.



Model 540 — Ideal miniature portable 6-range D.C. Volt-ammeter. Cannot "burn-out." Independent replaceable fuses protect each of the three current and three potential ranges. Compact Bakelite case. Mirror scale. Range changing switch. Precision type pocket size instrument. Reasonably priced.

Give students that feeling of confidence which comes from using Weston Instruments. Give yourself the satisfaction of purchasing instruments which are recognized the world over as standards of accuracy—a truly sound investment, combining long life and minimized servicing as Westons do.

Weston is continually pioneering in the art, developing new instruments to meet the ever changing conditions. Outstanding among the recent contributions is the Weston Photronic Cell.

This photo-electric cell is of an advanced type. It is radically different in design, simpler, and reduces the cost of application, primarily because it is a miniature power plant which converts light energy into electrical energy. No outside source of potential is needed to operate instruments or relays.

Throughout the Weston line, from this new Photronic Cell to the widely used miniature 3¼" instruments, exacting standards of craftsmanship prevail. The reliable performance resulting from Weston precision manufacture teaches a valuable lesson to the student of science. For this reason, Weston Instruments are the preferred equipment in schools and colleges.

There is a Weston instrument for every electrical testing requirement. Write for your copy of latest catalog, containing descriptive information and prices of the hundreds of models — many range combinations. Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark, New Jersey.

WESTON

• I N S T R U M E N T S •

(Continued from page 104)

Gardeners	Metal workers
Tailors	Designers and draftsmen
Brick and stone masons	Launderers
Printers	Stenographers
Molders and casters	Cabinetmakers
Clay, glass, and stone	Plasterers
Bakers	Garage men
Shoemakers	Jewelers
Tin workers	Filers and polishers
Motormen	Janitors

From this relatively small list of 38 occupations, a finer selection was made which seemed to fit our own special community and the boys of our student body. Here is where a great difference of opinion must rightly enter. Each community should place its own interests and industries first and therefore a farming district will teach farm mechanics while a city school may stress the building trades or those of the metal workers. Our own school being one where the student body is highly selective from a well-to-do community around a big university of a large city and where the majority will go to college, the following list has been selected as best suiting the needs of our students.

Machinists (work with iron and steel)	Electrician
Carpentry (lumber, cabinetmakers)	Plumber
Textile	Leather industries
Painters	Concrete, brick, and stone
Chauffeur (engineer)	Printing
Blacksmith	Contractors and builders
	Tin and metal
	Designers and draftsmen

These occupations have been organized into the following units with outlines or lesson plans for each student.

Benchwork	Home mechanics
Wood turning	Leather
Forging	Metal working
Machine lathe	Concrete
Drawing	Care of tools and toolroom (including safety measures)
Weaving	

Various substitutions in the problems contained in the individual outlines are allowed at the desire of the student and the discretion of the instructor.

Toolroom Method

Wesley L. Orr,

Denver, Colorado

Checking tools out and in, and keeping track of losses and breakages is a troublesome affair. Here is how one teacher solved the problem.

PROBABLY every industrial-arts teachers, at one time or another, has been puzzled as to the best method of checking tools out and in. The following method, admittedly far from perfect, is nevertheless offered in the hope that it might be of some help in the building of a checking system.

Surely every tool good enough to be used, ought to have an individual holder on the tool rack. Such a holder may vary from the easy and sometimes efficient system of nails driven into a wooden backboard to the more or less elaborately constructed holders of metal and wood. Tools which are to be checked out to students should all be hung in plain sight rather than placed in drawers or on shelves.

Whatever method is used in constructing the holders, the tools should be spaced consecutively and systematically on the rack. Of course, like tools should be placed together.

Besides having a holder, every tool should have a number. It has been found convenient to give each family of tools a distinguishing family letter and letting each member of the family be numbered consecutively. For instance, if the letter C represents hammers, then the second hammer from the left would be C–2 and its brother, the fifth hammer from the left, would be C–5. These characters should be stamped, or lettered, on each tool in such a way that they may be seen plainly when the tool is properly placed in its holder.

Such a method of numbering provides room for expansion without breaking the continuity of the system. If another hammer is added it may be numbered C–13 if there were twelve hammers previously. This system of numbering also is an aid in taking invoices and in keeping records of tools. More important, the tool may be checked out, not just as a hammer, but as a certain individual hammer. This places

(Continued on page 115)

Class Tool Boy Date

Tools broken or missing at beginning of period

Tools broken or missing at end of period

Name or number of student	Tool No.	Ck. in.	Name or number of student	Tool No.	Ck. in.

Toolroom Record Form

Portable Woodworking Machinery, Edgar Allen Poe Junior High School, San Antonio, Texas

(Continued from page 114)

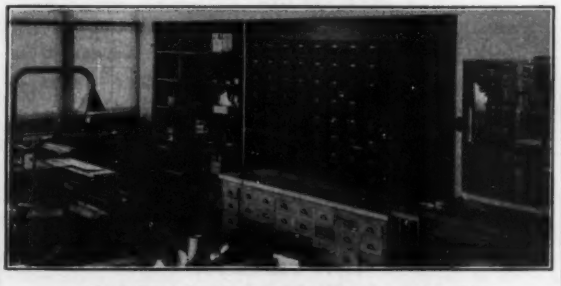
Johnnie Jones's responsibility on hammer No. C–2 and not on just any hammer he might find to check in.

Furthermore, if a record is kept of tools checked out, any tool found to be broken later may be traced to its last user. Not that Johnnie Jones wouldn't voluntarily confess to mistreating the head of hammer No. C–2, but that it is sometimes comforting for the instructor to have this information ahead of time, and for Johnnie Jones to know that the instructor will have it. A suggestive record form is shown in the accompanying illustration. The tool boy enters the student's name or number and the tool number when passing out the tool and checks it off in the space provided when it is returned. These records may be kept for a few days and then destroyed.

It is obviously necessary for every holder to be numbered to correspond to its tool. It may be found convenient to paint a red dot about a half inch in diameter under each tool in such a way that the red dot is hidden when the tool is hung up properly. The tool-holder number may be readily found if it is lettered in the red dot.

This dot has another purpose, however. It enables the instructor and tool boy, at the end of the period, to tell at a glance if all of the tools are checked in, the red dot plainly indicating any absence. This is especially helpful when the instructor is in a hurry. It may be found easier to paste red-colored paper dots under the tool rather than paint them on by hand.

Usually it will be found advisable to letter the family symbols on the rack consecutively. This helps in replacing checked-in tools. In cases of large tool assortments an index of tools may be posted near by and any tool readily found. This aids beginning students in becoming accustomed to the different tools.



Steel Tool Lockers in the Woodworking Shop

NEW BOOKS

McGRAW-HILL

ELEMENTARY INDUSTRIAL ELECTRICITY

New Second Edition

By **L. Raymond Smith,** Instructor in Industrial Physics, Wm. L. Dickinson High School, Jersey City, N. J. *Industrial Physics* series. 287 pages, 5½x8, illustrated. $2.00.

This revision of the author's popular *Direct-current Electricity* contains a general discussion of the more salient features of alternating-current phenomena, greatly increasing the book's scope and usefulness. As before, the author emphasizes fundamental principles and practical applications, and presents, in non-technical language, a wide variety of problems.

PRACTICAL ELECTRICITY

New Third Edition

By **Terrell Croft,** Consulting Engineer. 674 pages, 5⅜x8, illustrated. $3.00.

To this standard, widely-used text a new section on Vacuum Tubes and their use has now been added, and the section on Matter and the Electron Theory has been revised in accordance with modern views. Numerous minor changes have also been made, bringing the book completely up to date. The book is notable for its simplicity, technical accuracy, and the abundance of examples, problems and illustrations.

ON-APPROVAL COUPON

McGRAW-HILL BOOK COMPANY, INC.
330 West 42nd Street, New York

You may send me the books on approval. I understand that I am to return these books after a reasonable period of examination unless I either notify you of my intent to adopt them in my classes or remit for them.

☐ *Smith*—ELEMENTARY INDUSTRIAL ELECTRICITY
☐ *Croft*—PRACTICAL ELECTRICITY

Signed.....
Address.....
School.....
Official Position..... IAVE-2-33

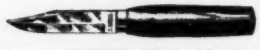
R·MURPHY
STAY SHARP
TRADE 1850 MARK
KNIVES
MADE SHARP AND STAY SHARP

Sloyd, Manual Training, Stencil and Wood Block Knives

Over 82 years of experience, research, and experimentation enable Robert Murphy craftsmen to offer knives of guaranteed quality. We are specialists in this line and make a knife for every purpose. There is a right type to fit the particular needs of your classes and you can depend upon the following list of knives to stand up under use and abuse and retain their finish and sharp cutting edge.

Send for Complete Catalogue

No. 0. SLOYD, Blade 1¾ in. long.



No. 1. SLOYD, Blade 2⅛ in. long.

No. 1½. SLOYD, Blade 3 in. long.

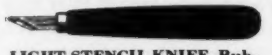
No. 2. SLOYD, Blade 3¼ in. long.

No. 3. SLOYD, Blade 3 in. long.

No. 2½M. MANUAL TRAINING, Blade 2½ in. long.

No. 1½C. CARDBOARD, Blade 1½ in. long.

STENCIL AND WOOD BLOCK KNIFE, Blade 2⅛ in. long.



LIGHT STENCIL KNIFE, Rubberoid Handles Riveted, 1 in. long, ¼ in. wide.

ROBERT MURPHY'S SONS COMPANY
AYER, Established 1850 MASS.

"ROUSE" PRINTSHOP TOOLS
for APPRENTICE and MASTER—

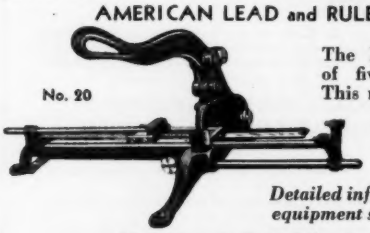
ROUSE COMPOSING STICKS

Especially made for school work. Sturdily constructed, notably low priced. Five other types available including the famous Rouse "Quarter Point" and "Micrometer" sticks.

ROUSE MITERING MACHINES

The trade's most popular miterer. Equipped with positive point gauge, "Panameric" Miterer is a lower priced model.

AMERICAN LEAD and RULE CUTTERS



No. 20

The No. 20 is only one of five cutters available. This model especially suitable for school print shops.

Detailed information on all equipment sent on request.

H. B. ROUSE & CO.
2214-16 Ward St. Chicago, Ill.

Lussky, White & Coolidge, Inc.
Chicago

Has served schoolmen for over a half century as a convenient and economical source of all Tools and Supplies used in

Manual Training
and
Woodworking Shops

Nationally known Hand Tools, also Supplies and Equipment at
DEALERS' DISCOUNTS

A complete line of Cabinet Hardware also available.

Schoolmen have learned that they can buy safely and wisely at Lussky, White & Coolidge, with the result that every year an increasing number of Supervisors and Instructors ask us to quote on their complete tool and supply lists.

Get acquainted with our complete, comprehensive line by sending TODAY for our 290-page Catalog "J." No Cost — No Obligation.

LUSSKY, WHITE & COOLIDGE, INC.
65-71 West Lake St.
Chicago, Illinois

Drafting Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.	Name and Description	No.
Adjustable-Curve Ruler		**Drawing-Board Supports, to be set on or attached to woodworker's bench**		**Steel Scales, 12"**.....	
Beam Compass		**Drawing Tables and Stools**		**Stop Watch, for mechanical-drafting students**.....	
Bench Brushes		For students.....		**Table**	
Blackboards		For teacher.....		For cutting and trimming drawings and blue prints.	
Compass, 15", with locking device		**Ink-Bottle Holder**.....		For disassembling and reassembling machine parts and models	
Drawing set: T square straightedge, triangle, and protractor		**Irregular Curves, Nos. 17, 21, and 24, wood, rubber, or transparent, each**		**Tapeline**	
Permanent or portable.....		**Lettering Angles**		100′ steel, for architectural students	
Blue-Print		**Lettering Pens, assortment of 12**		50′, steel or metallic.....	
Frame or machine.....		**Level or Transit, builders', for architectural students**		**Tool Box, containing 1 machinist's hammer, one 6" adjustable wrench, one 6" screw driver, one pr. 6" combination pliers**	
Washing trays or washer...		**Leveling Rod, for use with the transit**		**Triangles**	
Paper tube, air-tight.....		**Machinists' Combination Set, 12"**		30-60-deg. 14" transparent...	
Drying Rack or Dryer.....		**Marking Pins, for use with measuring tape, for architectural students**.....		45-deg. 10" transparent.....	
Bookcase, for reference library		**Micrometer, 1", for mechanical-drafting students**		**Triangular Scales, civil engineers' type, 12"**.....	
Cabinet		**Oilstone, 3" case**.....		**T Square**	
For filing drawings.....		**Pantograph, 21"**.....		Adjustable or fixed head, for large drawing board, or straightedge with parallel rule attachment for large drawing boards.....	
For storing drawing boards.		**Parallel Rules**.....		**Wall Charts, lettering, decimal equivalents, etc., each**.....	
For storing drawing instruments		**Planimeters**.		**Yardstick**	
For storing models.....		**Plumb Bob**			
Calipers		**Shears, for trimming blue prints and drawings**.....			
6" inside and outside, each..		**Speed Counter, for mechanical-drafting students**			
8" inside and outside, each..					
Desk					
Teacher's					
Chair to match.....					
Dividers, proportional.....					
Drafting machine and accessories					
Draftsman's Steel Protractor..					
Drawing Boards, large.....					

Drafting—Small Equipment

To be provided by, or for, each student

Drawing Board, size to be specified by the instructor..		**Pencil Compass**		**Slide Rule, 10", as specified by the instructor**.....	
Drawing Instruments, as specified by the instructor, sets..		**Penholder, for lettering pens**..		**T Square, to fit drawing board**	
Erasing Shield		**Pens, assorted, for lettering**...		**Triangles**	
Irregular Curve, Nos. 8 and 13, transparent, each		**Protractor, not over 5"**.....		30—60-deg., 10" transparent.	
		Scale, 12" architect's, triangular		45-deg., 8" transparent.....	
		Scale Guard.....			

Drafting Supplies

Bichromate of Potash, crystals, lb.		Cross-section, 8½"x11", reams		**Powder, for tracing cloth, cans**	
Blue-Print		Detail, 24"x36", reams.....		**Tracing Cloth, 36", yd**.....	
Paper, 36" wide, yd.....		Drawing, 24"x36", reams....		**Van Dyke**	
Writing fluid, bottles.....		Isometric, 7"x10", sheets....		Fixing salts, 4-oz. cans.....	
Paper		Tracing, 36", yd.....		Paper, 36", yd.....	
				Writing fluid, 2-oz. bottles..	

Drafting—Additional Supplies

To be provided by, or for, each student

Erasers		**Ink**		**Pencils, drawing, HB, 2H, 3H, 4H, and 6H, each**.....	
Cleaning		Black, waterproof, ¾-oz., bottles		**Pencil-Pointer Pad**.....	
Ink		Colored, if required, ¾-oz., bottles of each color.....		**Thumb Tacks**	
Pencil					

Eugene Dietzgen Co.

Chicago 2425 Sheffield Ave. **New York** 218 E. 23rd St. **San Francisco** 523 Market St. **New Orleans** 318 Camp St. **Pittsburgh** 805 Liberty Ave.
Milwaukee 611 N. Broadway **Philadelphia** 1521 Sansom St. **Los Angeles** 945 S. Broadway **Washington, D. C.** 407 Tenth St. S. W.

Manufacturers of

Drafting Instruments and Supplies

We have ten grades of drawing instruments—a grade for every purpose and purse. The top grades of our drawing instruments are the finest instruments obtainable, and are universally standard among the professional trade. Our school grades, the four most popular of which are listed below, are standard in practically every school in the country and are universally the choice among instructors who pride themselves on equipping their students with the best sets obtainable for the money expended. Each of our grades of instruments is put up in different size sets. Below you will find what we term complete six and seven piece sets. You will note that they are of two styles—the square or trigonal type and the flat, round type. The type of instrument is always a matter of individual choice.

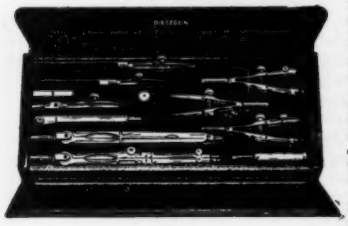
DIETZGEN ESTABLISHED 1885

It might be well to mention that all Dietzgen Instruments are made exclusively in Dietzgen Factories and are standardized. The parts in each grade are interchangeable. These parts are listed in our catalog, which affords complete replacement and repair part service at your finger tips.

We have arranged complete repair parts of the popular grades into repair kits. These kits will service about 50 instruments of one grade. Repairs can be made immediately, thus eliminating the inconvenience of having instruments lying around for repair, and holding work up.

"Federal" Drawing Instruments

An excellent quality, square American type, instrument. Substantially made of dense rolled nickel silver and steel, carefully finished. Compasses and Dividers equipped with differential straightening device. Compasses and Bow Instruments fitted with screw-thread needle points. Ruling Pen and Pen part of Compasses have slide-catch cleaning devices. Furnished in Pocket Case lined with Silk Velvet.

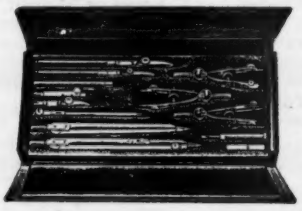


No. 1047

No. 1047 contains 5 and 5½-in. spring blade Ruling Pens; 3½-in. side-screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. hair spring adjustable Dividers; 6-in. Compasses with Pencil part, Pen part, and Lengthening Bar; Center Tack; Combination Screw Driver and Lead Box; Box with extra needle points.
No. 1046. Same as No. 1047, but without the 5-in. Ruling Pen.

"Universal" Drawing Instruments

A good quality, flat round type instrument. Made of rolled nickel silver and steel, nicely finished. Compasses and Dividers equipped with straightening device. Compasses and Bow Instruments fitted with adjustable and reversible needle points; Ruling Pens and Pen part of Compasses equipped with slide-catch Cleaning device. Furnished in Pocket Case lined with Silk Velvet.



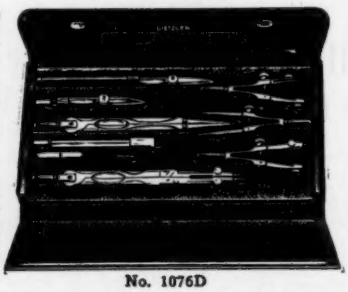
No. 1057C

No. 1057C contains 5 and 5½-in. spring blade Ruling Pens; 3¼-in. center screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. hair spring adjustable Divider; 6-in. Compasses with Pencil part, Pen part, Divider part, Lengthening Bar, and extra metal handle for use with Pencil and Pen parts of Compasses; Screw Driver and Lead Box; Box with extra needle points.
No. 1057. Same as No. 1057C, but Bow Instruments have side wheel.
No. 1056C. Same as No. 1057C, but without 5-in. Ruling Pen.
No. 1056. Same as No. 1056C, but Bow Instruments have side wheel.

"Scholar" Drawing Instruments

A square American type instrument, made of rolled nickel silver and steel. Compass and Dividers equipped with straightening device. Compasses and Bow Pencil have reversible and replaceable needle points. Furnished in Pocket Case lined with velvet.

No. 1076D contains 5½-in. spring blade Ruling Pen; 3½-in. side-screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. plain Dividers; 6-in. Compasses with Pencil part, Pen part, and Lengthening Bar; Key; Lead Box with extra leads.

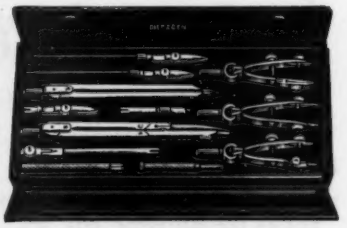


No. 1076D

No. 1077D. Same as No. 1076D, with addition of a 5-in. Ruling Pen.

"Prep" Drawing Instruments

A flat round type instrument made of nickel silver and steel. Compass and Dividers equipped with straightening device. Compasses and Dividers and Bow Instruments have reversible and replaceable needle points. Furnished in Pocket Case lined with Velvet.



No. 1087S

No. 1087S contains 5 and 5½-in. spring blade Ruling Pens; 3¾-in. side-screw Bow Dividers, Bow Pencil, Bow Pen; 6-in. plain Divider; 6-in. Compasses with Divider part, Pencil part, Pen part, Lengthening Bar, and extra metal handle for use with Pencil and Pen parts; Combination Screw Driver and Lead Box.
No. 1086S. Same as No. 1087S, but without the 5-in. Ruling Pen.

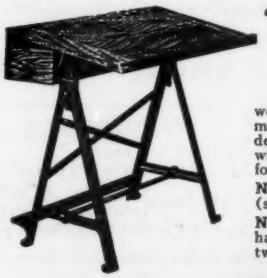
"Sheffield" Drawing Tables

"Sheffield" Drawing Tables are rigid and durable, and well adapted for drafting rooms in technical schools. They are 38 in. high and have a selected, well-seasoned white pinewood top and drawer furnished with lock and key.

No. 4434-6. Sheffield Drawing Table, with drawer 10½x25x3¾", with board 31x43".

No. 4435-7. Like No. 4434-6, but with drawer 37x25x2", with board 37x49".

"Madison" Drawing Tables



"Madison" Adjustable Drawing Tables are designed to meet all the requirements of an efficient and durable table for the classroom. They are of solid iron construction, with hardwood top, and are so arranged that they may be used, alternately, by two students, each table having two drawers with locks, for storing tools, and a shelf for holding drawing boards.

No. 4448. Madison Drawing Stand (stand only).

No. 4450. Madison Drawing Stand with hardwood top 25x32", with shelf and two drawers with locks.

"Ideal" Adjustable Drawing Tables

"Ideal" Adjustable Drawing Tables are strong, durable and rigid. They are made of hardwood, with well-seasoned pinewood tops, and are especially adapted for use in schools.

No. 4440-6. Ideal Drawing Table, with board 31x43".

No. 4441-7. Like No. 4440-6, but with board 37x49".

"Sturdy" Drawing Tables

"Sturdy" Drawing Tables are designed to meet the demand for a strong, sturdy, comparatively inexpensive drawing table. They are made of thoroughly seasoned hardwood with a selected white pinewood top, and are 34 inches high.

No. 4479B. Sturdy Drawing Table, Adjustable Top 36x72", with 6 file drawers 37¾x25x2", and 2 tool drawers 17⅝x25x3⅞", with 3-inch raising blocks.

Eugene Dietzgen Co.—Continued

Dietzgen Drawing Materials

We exercise a careful diligence in maintaining our reputation for quality, service and fair prices. Our special school prices appeal to all instructors.

Triangular Scales

No. 1626

U. S. Standard, machine divided, selected seasoned material, deep cut lines, fine finish.

No. 1626. Architects, mechanical engineers triangular boxwood scale; 12 in. open divided: 1/8, 1/4, 1/2, 1/4, 3/8, 1/2, 3/4, 1, 1 1/2, 3 in. to the foot, 1/8 in.....Each,
No. 31626. Like No. 1626, but of hardwood.....Doz.,
No. 1636. Civil Engineers triangular boxwood scale; 12 in. divided: 10, 20, 30, 40, 50, 60 parts to the in...Each,
No. 31636. Like No. 1636, but of hardwood.....Doz.,

Brass Protractors

Semi-Circular Brass Protractors divided in degrees both ways.

No. 1935L. 3 1/4 in., with scale on bottom, Each,
No. 1935R. 4 1/4 in., Each,

Transparent Celluloid Curves and Triangles

No. 2014. Thickness, .06", 30x60°, Plain, Size 4, 6, 8, 10, 12 inches.
No. 2015. Thickness, .06", 45°, Plain, Size 3, 6, 8, 10, 12 inches.

Accurately made, nicely finished. Seasoned material, retain their transparency and trueness, and will give years of satisfactory service for accurate work.

No. 2014 No. 2015 Sizes 13 and 15 Style No. 2152

Dietzgen Drawing Ink

The ink flows freely, dries quickly, contains no grit or acid, and is absolutely uniform. Universally used among artists and professional draftsmen, and in leading schools, colleges and universities.

No. 2681. Black and 10 fast brilliant colors. In 1/4 Oz., 4 Oz., 1/2 Pt., Pt., and Qt. Bottles.

Pencil Pointers

No. 3213. 12 sheets, 1 1/4x4 in., Sand Paper, with handle.
No. 3220. 12 sheets, 1 1/4x4 in., Emery Paper, with handle.

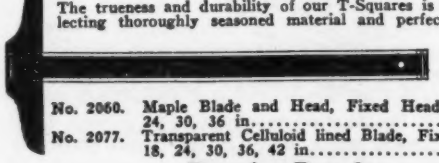
Stamped Steel Thumb Tacks

Made of best quality, nickel-plated hard steel, needle finish point, put 100 in a box or a dozen in a box.

No. 2440. 1/8 in., Box of 100. No. 2445B. 3/4 in., Box of 1 Doz.
No. 2441. 1/4 in., Box of 100. No. 2446B. 1/2 in., Box of 1 Doz.
No. 2442. 1/2 in., Box of 100. No. 2447B. 1 in., Box of 1 Doz.

T-Squares

The trueness and durability of our T-Squares is obtained by selecting thoroughly seasoned material and perfect workmanship.

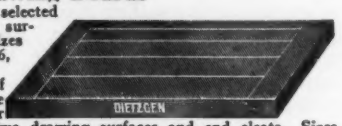


No. 2077

No. 2060. Maple Blade and Head, Fixed Head, Sizes 18, 21, 24, 30, 36 in.....Each,
No. 2077. Transparent Celluloid lined Blade, Fixed Head, Sizes 18, 24, 30, 36, 42 in.....Each,

Drawing Boards

No. 4406. Made of strips of selected white wood. Two drawing surfaces and end cleats. Sizes 16x22, 18x24, 20x24 1/2, 20x26, 23x31 in.



No. 4410. Made of strips of selected, well-seasoned white pine wood joined together by tongue and groove. Two drawing surfaces and end cleats. Sizes 16x22, 18x24, 20x24 1/2, 20x26, 23x31 in.

Mechanical Drawing Paper

Size 19x24, per quire or ream.

No. 9. White, slightly grained surface, strong, excellent erasing qualities, a perfect pencil paper, suitable for ink or color work.
No. 9A. Same as No. 9, but smooth surface.
No. 10. White, a good school drawing paper, slightly grained surface.
No. 11. Light cream, slightly grained surface, strong, stands erasing well, takes ink, pencil or color.
No. 11A. Light cream, high grade, slightly grained surface, strong, excellent erasing qualities. Takes pencil, ink, or color.

We have special discounts for Schools and Institutions. Write us your requirements and let us send you an estimate of cost.

Blue Printing Equipment

Without Blue Printing equipment in the classrooms, both instructors and students are hampered. Mechanical drawing students are unable to see the reproduction value of their efforts unless they themselves make prints. Shop students are unable to secure thorough experience in working from blue prints. Instructors cannot fully impress students with the real purpose of mechanical drawing . . . which is to make drawings from which prints are made for the shop or building foreman's guidance.

Dietzgen Junior Vertical Electric Printing Machine

Will print clear, sharp, distinct prints fast and with great economy. The print is uniformly exposed over its full area. The Junior has the same sturdy construction, the same type of Speed Regulator and Automatic Cut-off which have made the Dietzgen Senior so satisfactory. The machine has a half cylinder of glass with an open printing surface of 24x36 inches; glass is held in a felt lined metal frame.

Roller Curtain—The tracing and sensitized paper are held in place by Roller Curtains. Rollers hold curtain at uniform tautness over the entire surface of the glass.

Hi-Power Arc Lamp—The specially designed Hi-Power Arc Lamp gives off an intense light, rich in printing qualities. It consumes 12 amperes on 110 or 220 volts, 60 cycle, A.C., and 25 amperes on 110 and 220 volts, D.C. A satin-finish aluminum reflector insures the best possible distribution of light.

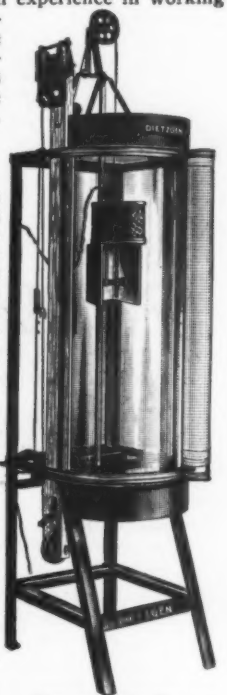
Speed Regulator — An improved pneumatic Speed Regulator insures uniform speed in the descent of the lamp. It is noiseless in operation, absolute in its regulation, and provides for a wide range of speed.

Automatic Cut-off — The Dietzgen Automatic Cut-off automatically extinguishes the light at any desired point. This permits machine to be loaded, set in operation, and left unattended, without possibility of prints becoming over-exposed.

No. 4334—Height, 83 inches. Occupies 18x22-inch floor space. Finish, beautiful brown enamel frame Printing surface sheets 24x36 inches or smaller, complete with Lamp No. 4348-1 for 110 volt D.C. or 60 cycle A.C., or Lamp No. 4348-2 for 220 volt D.C. or 60 cycle A.C.

No. 4336 "Senior"—Height, 9 feet. Occupies 3 square feet floor space. Two printing surfaces, each 42x60 inches.

When ordering, state voltage and whether current is direct or alternating.



Dietzgen Junior Blue Printing Unit Illustrated. No. 4334-I Vertical Electric Printing Machine, above. No. 4310A Junior Sheet Washer, below.

Dietzgen Junior Sheet Washer

This washer, especially designed for use with the Dietzgen Junior blue printing machine, thoroughly washes and develops blue prints and negative prints in sheets.

No. 4310A—For prints 24x36 inches or smaller, floor space 24x32 inches, with tray 28 inches wide. Complete with chemical tray and brush. Many unusual and excellent features.

To Save Your Needed Time

This booklet, the "Use and Care of Drawing Instruments," covers thoroughly the details of this subject. Available to Instructors gratis for distribution at the beginning of the semester. Give us the number of students anticipated, and the beginning date of next semester, and we will send you that quantity in proper time.

The **ROMANCE OF INDUSTRY**

A PRIZE CONTEST

And a new idea to lend classroom interest and enthusiasm to the study of mechanical drawing!

Created by J. H. Constantine, Director of Industrial Education, Passaic Public Schools.

Sponsored by Chas. M. Higgins & Co., Inc., for fifty-two years manufacturers of Higgins' American Drawing Inks.

IN this presentation for teachers, mechanical drawing is interpreted in the language of today's industry. *New Classroom interest and enthusiasm are created.* Fine prizes in cash, drawing ink sets and bronze medallions are added incentives. These interesting projects may be paralleled, elaborated upon or copied outright, as you prefer. They come from the board of an authority nationally known for his theories and his work—they come to you at a time when they should be doubly welcome—because there has been a noticeable lack of good material available. You can use these new projects as *your own* requirements dictate.

Write at once for this material and the contest details. Good specimens done as your regular class assignments may be entered. Originality in conception is encouraged. Nothing has been omitted to make this contest as interesting as possible for both teacher and student alike! And for best results, *in all of your work,* BE SURE TO SPECIFY AND USE HIGGINS' AMERICAN DRAWING INKS—the world's standard since 1880.

HIGGINS' AWARD CONTEST

Closes March 15!

USE THIS COUPON

CHAS. M. HIGGINS & CO., INC.,
271 Ninth St., BROOKLYN, N. Y.

Kindly send me, without obligation, a copy of your "Romance of Industry" project sheets and outline of the Higgins' Award Contest.

Name.....

Mail Address.....

School.....

.....

A DRAWING-ASSEMBLY ROOM

Vick L. Langford, Eastern Illinois State Teachers College, Charleston, Illinois

When the practical-arts building at the Eastern Illinois State Teachers College was designed, the need for an assembly room was expressed. This room was to be used for the regional meetings of the industrial-arts section of the state teachers association, as a lecture room for special speakers, or for other occasions when the entire manual-arts group of the Teachers College would be present, and for the annual manual-arts exhibits.

Space did not permit the setting aside of a room of this size which would be used only at such infrequent intervals. The problem was finally solved by L. F. Ashley, director of practical arts at the Eastern Illinois State Teachers College, who suggested a combination drawing-assembly room.

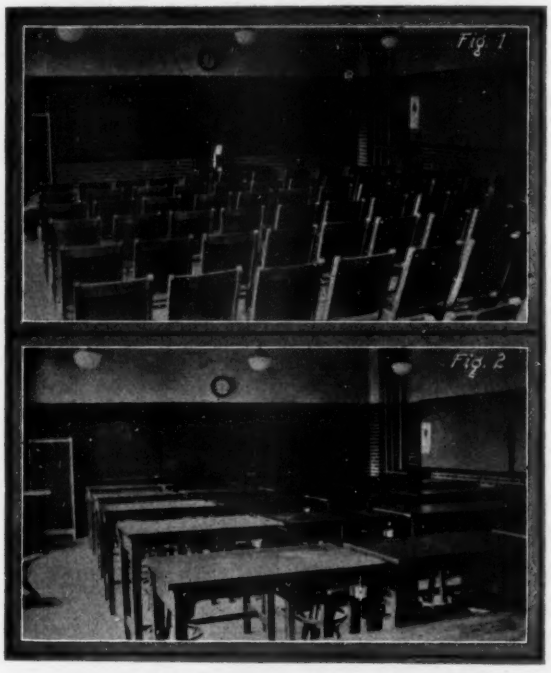


Fig. 1. Shows room set up for an assembly.
Fig. 2. Shows the same room with the equipment ready for the drawing class

When the room was ready for occupancy, the drawing tables were properly arranged, and their location laid out on the floor. A template was then made and used as a guide to bore ½-in. holes, 2¼ in. deep, in the back legs of each drawing bench and in the floor where it was to be located. Iron dowels, ½ by 4 in. in length, were cut, the dowels placed in the holes, and the benches put in place. This locates the drawing benches and holds them rigidly. When the room is needed for an assembly, the benches are lifted from the dowels and each set is placed in the drawer of the bench to which it belongs. Two men can clear the room of benches and place the chairs in less than an hour. Figure 1 shows the room used as an assembly room, and Figure 2 shows how it appears when it is used as a drawing room.

—◎—

THE TEACHING JOB

Take a big view of your job. Influence character, influence the lives of pupils. The object of teaching is twofold: (1) to impart knowledge, and (2) to influence character. In the main, it doesn't make so much difference what is taught, as it does how it is taught. Teach the job for the boy's sake.—*Lewis Gustafson.*

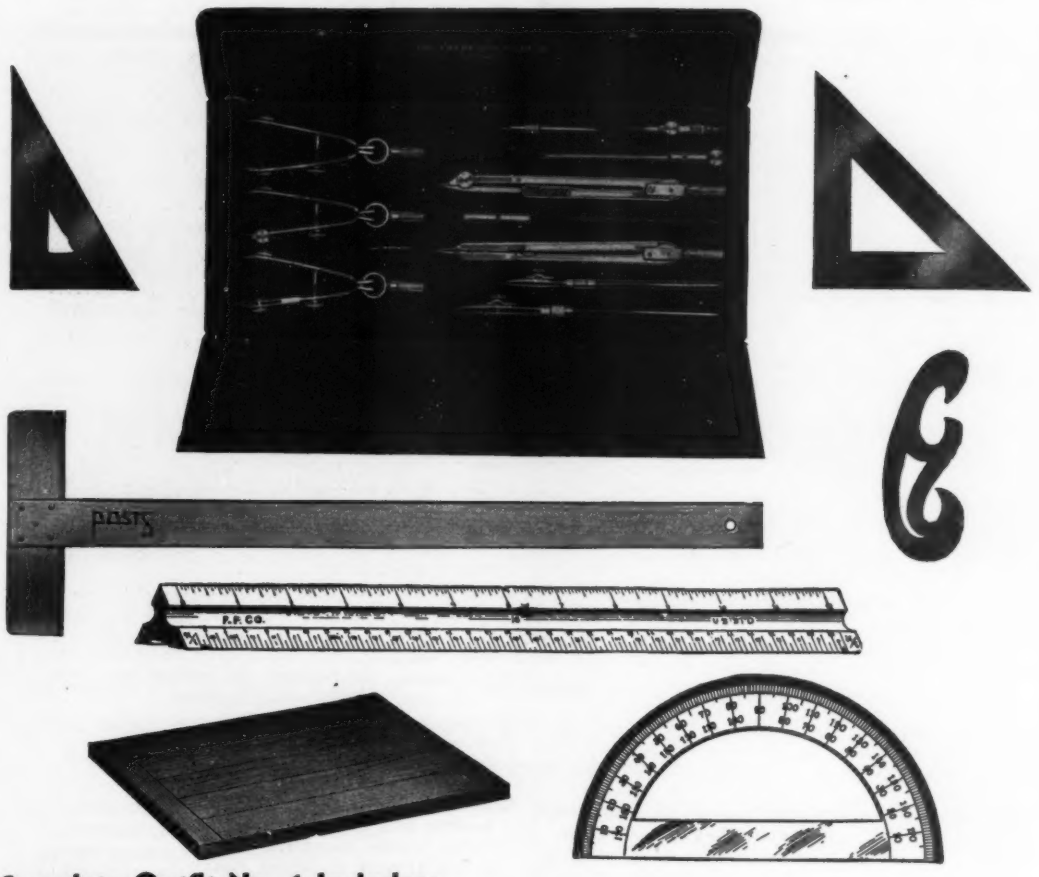
THE FREDERICK POST COMPANY

An Outstanding Value!

COMPLETE OUTFIT NO. 1

LIST PRICE $9.90

Price to Schools, $5.94



Complete Outfit No. 1 Includes:

A Set of Instruments consisting of:

4½″ ruling pen { both with releases } Bow Divider 3½″ Bow Pen 3½″.
5½″ ruling pen { both with releases } Bow Pencil 3½″ Plain Divider 5½″.
5½″ Compass with fixed needle point leg, divider, pen and pencil parts and lengthening bar with straightening device, metal handle, key, leadbox and repair vial, put up in handsome velvet lined pocket book style case.

18x24″ Drawing Board
24″ T Square
8″- 45 degree celluloid Triangle
10″- 30x60 degrees celluloid Triangle
Pencil pointer
Curve
Ink Eraser
Protractor
Art Gum
Thumb Tacks
Architect's Scale

ALL FOR $5.94

The merchandise in this outfit is fully guaranteed against defects in workmanship and material.

P. O. BOX 803, CHICAGO, ILL.

THE FREDERICK POST COMPANY

Printshop Equipment and Supplies

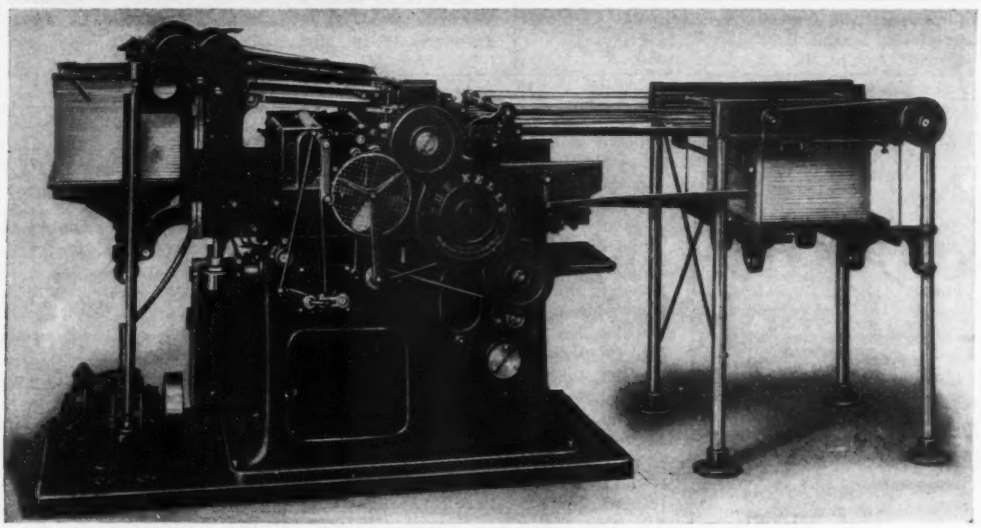
Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	*No.*
Bellows	
Hand, small-size	
Electric, blower-type	
Blackboard, permanent or portable	
Bookcase, for reference books, catalogs, etc., sectional preferable	
Brayer, 6- or 8-in., for proofing	
Brushes	
Bench	
Benzine, No. 1, oval back	
Padding, 1½ in. wide	
Bulletin Board	
Cabinets	
Galley, for double-column galleys, wood or steel, four tiers (to be used with typesetting machines)	
Galley, for 8¾ by 13-in. galleys, wood or steel, four tiers	
Ink and Roller, to accommodate platen-press rollers, wood or steel	
Matrix, for use with typesetting machines only	
Roller, cabinet or rack for cylinder rollers	
Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine	
Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copy holder	
Type, complete with 24 full-sized California job cases, with overhead lead-and-slug cases, wood	
Type, complete with 24 full-sized California job cases, double work bank, wood or steel	
Wood or metal, for filing class records, instruction sheets, etc	
Blank, full size, to accommodate ¼-size cases	
Border, ¼ size, for ornamental borders	
Lead and Slug, regular size, to hold labor-saving fonts of leads and slugs	
Metal Furniture, to hold labor-saving fonts	
Rule, ¼ size, for brass rule	
Cans	
Benzine, pint size	
Benzine, 5-gal. size	
Kerosene, safety, 1-gal. size	
Waste Can, fireproof, for rags	
Chairs, tablet-arm	
Chases, (for each size of platen press)	
For cylinder press	
Chase Racks	
For platen presses	
For cylinder presses	
Composing Sticks	
6 x 2 in., adjustable	
8 x 2 in., adjustable	
12 x 2 in., adjustable	
18 x 2 in., adjustable	
Cutter	
Lead and Rule	
Paper, lever-type, 20-in., with pedestal. Should handle 20 by 26-in. sheet	
Paper, lever-type, 26 or 30 in.	
Paper, lever-type, 30-in., with divided back gauge, or 30 to 36-in power cutter	
Desk	
Teachers', with drawer compartments	
Chair to match	
Drying Racks	
Combination drying rack and stock table for platen presses, 30 trays	
Trays, interlocking, for cylinder press	
Folding Bones, (for hand folding)	
Folding Machine	
20 by 26-in. size, 4-fold, two parallel and two right-angle folds, power	
Ink Fountains	
Short, for 8 by 12 press	
Short, for 10 by 15 press	
Long, for 10 by 15 press	
Short, for 12 by 18 press	
Long, for 12 by 18 press	
Furniture	
Iron, 2 by 4 to 10 by 15 picas, fonts	
Galleys	
Steel, 8¾ by 13 in.	
Steel, 6¼ by 23½ in., double column	
Steel, 12 by 18 in.	
Gauge Pins, spring-tongue, doz.	
Glue Pot, electric, 1-qt. size	
Imposing-Tables	
12 by 18-in., with iron top, including reglets and furniture	
24 by 36-in., with iron top, complete with galley slides, chase rack, reglets, and furniture	
36 by 48-in., with iron top, complete with galley slides, chase rack, reglets, and furniture	
39 by 63-in., with iron top, complete drawers, letter boards, reglets, and furniture	
Knives	
Overlay, for make-ready	
Ink, 6 in., round end	
Ink, 8 in., round end	
Ink, 8 in., square end	
Leaders	
6-pt. fine dot, lb.	
8-pt. fine dot, lb.	
10-pt. fine dot, lb.	
8-pt. hyphen, lb.	
10-pt. hyphen, lb.	
Leader Boxes	
Line Gauges	
Metal, brass, or steel	
Wood, doz.	
Metal Furnace, for recasting and refining type metal, used only with typesetting machines	
Mitering Machine	
Numbering Machines	
For use on presses	
Hand machines	
Ornaments	
Assorted floral and decorative designs	
Border, 6-point, decorative, fonts	
Border, 12-point, decorative, fonts	
Perforator	
24-in., foot treadle	
28-in., foot treadle	
Planer	
Mallets, hickory or fiber	
Proof, maple, with felt bottom	
Type, maple, with leather top	
Presses	
Cylinder, two-revolution, four-roller, 25 by 38, complete with variable-speed motor, cast rollers, etc	
Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake and set of cast rollers. (Motor and treadle combination if desired)	
Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc	
Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc	
Proof, 14 by 18, with cabinet	
Proof, 20 by 24, with cabinet	
Punch	
Foot-power, multiple, with assorted punches	
Lever, two-die, with assorted punches	

(Continued on page 124)

SCHOOLS AND COLLEGES ARE RAPIDLY INSTALLING

The Style B Kelly
AUTOMATIC PRESS



The Style B Kelly Automatic Press with Extension Delivery and Fan

The Style B Kelly Automatic is especially suitable for school purposes. *May be equipped for hand feeding. Not necessary to lift forms off press for correction.* Combines facilities for instruction on automatic and cylinder presses.

STANDARD SPECIFICATIONS OF STYLE B KELLY

Bed measurement, 20⅛x22⅜ inches.
Size of standard sheet, 14½x22 inches.
Largest sheet fed, 17x22 inches.
Feeder pile table holds 12½ inches of stock.
Standard speed range, 2200 to 3600 per hour.
Speed range reduced for hand feeding.
Floor space over all with jogger delivery, 6 feet 6 inches x 3 feet 6 inches.
Spare parts for Kelly Presses and service organizations at all Selling Houses.
All composition rollers cast 2⅛ inches.
Motors, controller and push button station wired at factory ready for main line.
Floor space over all with extension delivery, 10 feet 3 inches x 3 feet 6 inches.
Floor space of floor plate, 6 feet 1 inch x 3 feet 1 inch.

OTHER KELLY PRESSES

Style A, sheet size, 13½x20 inches. No. 1, sheet size, 22x28 inches. No. 2, sheet size, 24x35 inches.

Above presses equipped for automatic feeding only

For prices and further information, address EDUCATION DEPARTMENT

AMERICAN TYPE FOUNDERS COMPANY

300 Communipaw Avenue, Jersey City, New Jersey

(Continued from page 122)

Name and Description	*No.*	*Name and Description*	*No.*
Power, multiple, with assorted punches. (Paper drill may be substituted)		Slugs, labor-saving, 6-point, lb.	
Quoins		Slugs, 2-ft. strips, 6-point, lb.	
No. 1 size, doz.		Spaces and quads	
No. 2 size, doz.		Thin spaces, brass and copper, assorted sizes, 6 to 18 points, one size in each box, sets	
Keys, No. 1 size		*Specimen Display Board*	
Keys, No. 2 size		*Staple Binder*, pedestal-type, foot power	
Rule, plain, brass, (fonts to fit quarter cases)		*Stitcher*, wire, power, capacity ½ or ¾ in., flat and saddle-back tables	
2-point, labor-saving, hair-line, side face, fonts		*Tympan Paper,* (with combination holder and cutter)	
2-point, labor-saving, 1 point side face, fonts		18-in., rolls	
1-point, labor-saving, 1 point face, fonts		38-in., upright, to be used with cylinder press only	
2-point, labor-saving, double face, fonts		*Typesetting Machines*, either linotype or intertype, 2 or 3 magazines, and molds	
Saw Trimmers, pedestal type, with point gauge, and raising and lowering table		Matrices for same, 6, 8, 10, and 12-point, as selected, fonts	
Spacing Material		Tweezers, 3½-in., doz.	
Iron furniture, as selected, fonts			
Leads, labor-saving, 2-point, lb.			
Leads, 2-ft. strips, 2-point, lb.			

Name and Description	*No.*	*Name and Description*	*No.*	*Name and Description*	*No.*
Type		18-point, No. 30, fonts		12-line, fonts	
Body, Lightface—		Job, Light Copperplate Gothic—		15-line, fonts	
8-point, lb.		6-point, No. 1, fonts		18-line, fonts	
10-point, lb.		6-point, No. 2, fonts		10-point, fonts	
Job, Lightface—		6-point, No. 3, fonts		12-point, fonts	
6-point, fonts		6-point, No. 4, fonts		14-point, fonts	
8-point, fonts		12-point, No. 5, fonts		18-point, fonts	
10-point, fonts		12-point, No. 6, fonts		24-point, fonts	
12-point, fonts		12-point, No. 7, fonts		30-point, fonts	
14-point, fonts		12-point, No. 8, fonts		36-point, fonts	
18-point, fonts		Job, Condensed Title Gothic—		48-point, fonts	
24-point, fonts		12-point, fonts		60-point, fonts	
30-point, fonts		18-point, fonts		72-point (caps only), fonts	
36-point, fonts		24-point, fonts		Job, Boldface Italic—	
48-point, fonts		36-point, fonts		8-point, fonts	
Job, Lightface Italics—		48-point, fonts		10-point, fonts	
8-point, fonts		60-point, fonts		12-point, fonts	
10-point, fonts		72-point, fonts		14-point, fonts	
12-point, fonts		Job, Text Type—		18-point, fonts	
14-point, fonts		10-point, fonts		24-point, fonts	
18-point, fonts		12-point, fonts		30-point, fonts	
24-point, fonts		14-point, fonts		36-point, fonts	
36-point, fonts		18-point, fonts		Job, Heavy Copperplate Gothic—	
Job, Boldface—		24-point, fonts		6-point, No. 21, fonts	
6-point, fonts		Job, Typewriter Type—		6-point, No. 22, fonts	
8-point, fonts		12-point, with spaces, lb.		6-point, No. 23, fonts	
12-point, No. 26, fonts		Wood, Condensed Gothic—		6-point, No. 24, fonts	
12-point, No. 27, fonts		8-line, fonts		12-point, No. 25, fonts	
12-point, No. 28, fonts					

Supplies

Name and Description	*No.*	*Name and Description*	*No.*
Benzine or Gasoline, for cleaning type or presses, gal.		Bond, sulphite, 17 by 22 — 16, white, reams	
Bindery Tape, 2 in. wide, brown or black, rolls		Bond, sulphite, 17 by 22 — 16, colors as selected, reams	
Gold Bronze, pale, lb.		Book, enamel, 25 by 38 — 80, white, reams	
Gold Size, lb.		Book, machine finish, 25 by 38 — 80, white, reams	
Ink		Book, eggshell finish, 25 by 38 — 60, white, reams	
Bond, black, for bond papers, lb. cans		Cover, as selected, sheets 20 by 26, medium	
Book, black, for school paper, etc., lb. cans		Card Bristol, fine grade, 22 x 28 — 4 ply, white, sheets	
Cover, colors as selected, lb. cans		Index Bristol, medium grade, 25½ by 30½ — 110, white, sheets	
Cover, colors as selected, ½-lb. tubes		Index Bristol, medium grade, 25½ by 30½ — 140, white, sheets	
Dryers and Compounds, as selected, lb. cans		Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected, sheets	
Halftone, black, lb. cans		Press Board, red, sheets	
Job, colors as selected, lb. cans		Strawboard, No. 40 or No. 50, bundles	
Job, colors as selected, ½-lb. tubes		Tag Board, manila, 24 by 36 — 140, sheets	
Metallic, gold and silver, lb. cans		Tympan, to fit presses, rolls	
Process, black, red, yellow, blue, lb. cans		Wrapping Paper, size as selected, rolls	
Kerosene, for cleaning rollers, gal.		Holder for same	
Padding Cement		*Twine,* cotton, for tying jobs, lb.	
Cold, gal.		*Wire Stitching*	
Hot, lb.		No. 25 round wire for stitcher, spools	
Paste, Bindery, pints		Wire Staples, ¼ in., for stapling machine, 5,000 in box, boxes	
Make-ready, lb.			
Paper			
Bond, fine grade, 17 by 22 — 16, white, reams			
Bond, medium grade, 17 by 22 — 16, white, reams			

Western States Envelope Co.

1616 West Pierce St., Milwaukee, Wis. **Long Distance Phone Orchard 9310**

Manufacturers of

Felt Brush Gummed Envelopes

We are closely affiliated with the printing trade, and through years of study have been enabled to work with and help solve the envelope requirements of modern business.

All of this experience is available to school print shop instructors. The envelope requirements of modern business have become so varied that it is important that every boy entering Industry be properly informed.

What We Are—What We Make What We Do

THE WESTERN STATES ENVELOPE COMPANY was organized May, 1908, with one idea in mind, namely — that of operating an envelope factory that would do as printers would do if they were running it themselves.

We have done as much for you or even more than you would have done for yourselves had you been in our place; in fact, it can truthfully be said at this time that we are "YOUR ENVELOPE MANUFACTURER." Operating your Envelope Service Station.

Our first business is to plan and develop the envelope business in the interests of the printer and lithographer.

WE ARE EMPHATICALLY INDEPENDENT IN EVERY WAY.

WE MAKE all the regular sizes of commercial and official envelopes, from six to fourteen, including the special flaps of which we have over thirty-nine different styles. See Trade Circular No. 2.

Envelope Trade Names and Sizes

6	Commercial	3⅜x 6	10	Official	4⅛x 9½
6¾	Commercial	3⅝x 6½	11	Official	4½x10⅜
7	Official	3¾x 6¾	12	Official	4¾x11
7½	Two-fold	3⅞x 7½	14	Official	5 x11½
9	Official	3⅞x 8⅞	6¾	Reverse Face	3⅝x 6½

Included in our complete line of envelopes are a full range of Look-In, Window, Bankers Flap, Catalog, Coin, Collection, Baronial Catalog, Report Card, or any other kind of envelope you may possibly want. We also make special envelopes of all sizes and kinds from any paper.

In addition we carry a complete line of die-cut cards for all purposes in kid, plate, and linen finishes. Our visiting cards may be furnished plain or panelled. Our line of wedding and announcement stock is very complete. Also round corner cards in white and colors suitable for tickets, meal checks, etc. Write for samples and prices.

A Print Shop Project

Why not have your school print shop print all of the envelopes for your school, or for that matter, for your entire school system? We have every variety of size and grade available. We shall be pleased to furnish the paper and layouts for flat printing or just layouts for you to print on stock which you may have on hand, we to make the envelopes up after you are through printing. We have worked out this service particularly well and shall be pleased to coöperate with you in this way. The "Guide Book" described in the next column should have a place in your school print shop, as it is very instructive. Do not fail to send for it.

Guide Book through Envelope Land

Write for This Informative Envelope Book

This book contains the following bonafide Trade Information

Page 32 gives the number of envelopes out of almost any size of paper. This even includes Baronial Envelopes.

Pages 32-33-34 and 35 give prices for making envelopes from furnished stock, plain or printed.

Pages 44-45-46 and 47 give illustrations of different types and styles of envelopes.

Pages 36 and 37 lists unusual envelope papers not regularly carried in stock.

All the above is yours for the asking without any obligation.

Supplying envelope requirements for school systems is our specialty. We will gladly assist in making up your specifications, and will submit bids at any time, on any numbers of envelopes desired.

Envelopes are in stock for immediate shipment, in all grades of stock which include a numerous variety and quality of bonds and krafts.

Western States Felt Brush Gummed Envelopes

A New Type Envelope
which is guaranteed to eliminate gumming and envelope printing difficulties.

By this method the gum is brushed into the pores of the paper and on to the sealing portion of the flap. The flap is larger in size than usual which in addition to other advantages assures good sealing even with hard sized papers.

Felt brush gumming has been in use over two years and has been found very satisfactory. The presence of lumpy gum under the printing side the sealing flap has been eliminated and the tendency to dish, wrinkle or warp has been largely done away with. The design of the sealing flap is also new, and one that shortens make-ready time when printing envelopes.

Felt brush gummed envelopes are also scored before folding, thus assuring square envelopes that pack tightly and consequently occupy less space.

Western States Envelope Co., 1616 West Pierce St., Milwaukee, Wis.

The School Shop Shopping Guide

50 New Projects

ERINOID
IVERLOID
CATALIN
FIVE METALS
EMBOSSING METALS

CELLULUX REED
SAME—WIRE CORE
FELT
GIMP LACING
PERMATEX

Headquarters—new ideas, new materials, new methods, also all standard supplies. Let's get acquainted—write today for samples of new products.

Yellowcrafters Inc.
739 BOYLSTON ST., BOSTON, MASS.

HOLD-HEET Glue Pots
for trimmed budgets

1 qt., $14
2 qt., $17
4 qt., $24
8 qt., $36
115 or 230 Volts

Only HOLD-HEET sales volume permits this performance at these prices

Only by selling more than any two other makers, can HOLD-HEET offer: Accurate thermostat (to 1°). Shock-proof 20-year element that saves glue and electricity. Sturdy construction—14 superior design features . . . with low initial cost. OK'd by Underwriters. Unconditionally guaranteed for 1 year.

Test a HOLD-HEET for 30 Days FREE
Write size and voltage wanted. Test in your own glue-room. If not best in every way, send it back.

Ask Your Jobber RUSSELL ELECTRIC COMPANY
364 West Huron St., Chicago, U.S.A.

CHANGE ATTACHMENTS *Instantly*

CARVE, DISC, DRILL, GRIND, POLISH

A REAL TOOL—*Not a Toy*

MASTER BENCH HEAD BUILT TO LAST A LIFETIME

Each attachment is mounted on a mandrel and is in perfect alignment. To change attachments, merely loosen handwheel and slip into draw-in collett. List price $4.00.

Special Offer: Send $3.00 for Master Bench Head postpaid or C. O. D. We will send you FREE one 4"x ¾" all-purpose grinding wheel and 4" buff mounted on separate mandrels. Write for booklet.

Let us quote you on grinding wheel specifications.

WISCONSIN ABRASIVE COMPANY
Dept. 8572 Station A Milwaukee, Wis.

NOW VENEER-PROJECTS *for your classes*

HJORTH, of the Saunders Trade School, Yonkers, N. Y., author of "Principles of Woodworking," has opened a whole new field of possibilities for the vocational instructor. No longer is it necessary to limit projects to solid wood. Now you can teach laminated construction, introduce really valuable projects in fine veneering—with results that equal the finest products of our leading furniture makers. Hjorth's text, "How to Make Veneered Panels," shows in workmanlike language and illustrations, exactly how veneers are cut; how veneered panels are assembled, glued and finished; and suggests new projects. A modern, inexpensive steel veneer press is described, and source of supply listed for needed materials. *Fourteen chapters, ninety-six pages, sixty-five illustrations.*

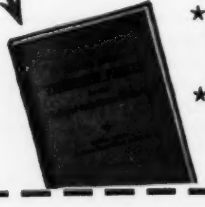
This clothbound book is being distributed without profit, $1.00, postpaid. Regular school board purchase orders accepted, if more convenient.

$1

Special Introductory Offer!

Frankly, we think this new book will promote veneering, and as a result sell more Casco Glue to Manual Training Schools. We cannot afford to give the book away, but for a limited time, a dollar's worth of Casco material will be given away with Hjorth's book...Here's what we send you *free* in addition to Hjorth's book, which in itself is splendid value for $1.00.

This offer embraces a complete education in modern cold gluing methods . . . Take advantage of it . . . Mail the coupon TODAY.



★ ½ lb. can CASCO Stain-free Glue (No. 2—white) offered specially for Manual Training needs.
★ 1 CASCO "Rapid-Spread" Glue Brush
★ New CASCO Red Book, 7th edition (the manual of factory use of CASCO Glue)
★ New CASCO Gluing Guide (over 50 uses for CASCO Glue, and how to make inexpensive waterproof Crack Filler).

IA 2-33

The Casein Manufacturing Company of America, Inc.
205 East 42nd St., New York, N. Y.

Gentlemen: Please send Hjorth's "How To Make Veneered Panels" and combination free material. I enclose $1.00—check ☐ cash ☐

*Name*_____
*Street*_____
*Post Office*_____
*School*_____

Drafting Room Supplies

DRAWING INSTRUMENTS. We feature Richter instruments, noted for high quality and long life. Have absolutely true and steady joints that never work loose. Also wide selection of other instruments.

DRAWING TABLES—DESKS—CASES. Our line includes the "Simplex," "Monroe," "Ideal," "Champion" and other well known "Hamilton" drawing tables. We also carry adjustable stands, sectional filing cases and steel blue-print cabinets.

DRAWING PAPER & SUPPLIES. Wide variety of tracing cloth, drawing and tracing paper to choose from. Furnished in sheets or rolls. Blue-print paper very uniform and strong. Drawing Boards, T Squares, Triangles and Curves in various sizes and styles.

Our catalog contains a complete list and describes all materials necessary for the well equipped drafting room. Copy sent on request.

U. S. BLUE PRINT PAPER CO.
201 So. Wabash Ave., Chicago, Ill.

Complete Series of Books for School Shop Craftwork

LEATHERCRAFT: Complete information on practical and simple methods of doing leatherwork.
METAL CRAFT: Practical and simple instructions on metalwork showing how this craft can be done with very few tools.
LINOLEUM BLOCK PRINTING: Instructions on practical method of cutting and printing with linoleum blocks.
BASKETRY: Instructions and practical information on simple and intricate reed basketry weaving.

ALL BOOKS 35c PER COPY

When you write for these booklets, also ask for our catalog. We carry a complete line of equipment and supplies for all the above and related subjects.

National Crafts Supply Co.
94 Lexington Ave., New York, N. Y.

Printers Supplies

Safety appliances for Platen Presses; Gideon Grippers; Ink Rollers; Complete Printing Plants—Outfits for schools or students. Write for catalog. Another source of supply

Globe Type Foundry, Est., 1904
523 SOUTH GREEN STREET CHICAGO ILLINOIS

CEDAR CHESTS--CABINETS

Genuine Aromatic Moth-Killing Tennessee Red Cedar—kiln dried, glued-up, planed, cut-to-size—for chests.
Also, Cherry, Walnut, and Maple for cabinets and furniture tops.
Write for illustrated folder.

HARTLEY AKIN LUMBER CO.
Cincinnati, Ohio

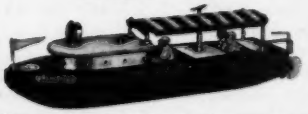
Tools for the SCHOOL SHOP & supplies

Our complete hardware line assists in project completion & decoration

Send Us Your Tool Lists for Our Wholesale Prices

Gross Hardware
822 N. Third Street
Milwaukee, Wisconsin

BOATS



Spring Motors, Parts, Accessories, Redwood Blocks, Complete Kits
Write for Catalog and Prices
LIBERTY PLAYTHINGS
Niagara Falls, N. Y.

ELECTRO-TYPERS

Especially qualified to be of service to the school printshop.

Promptness and quality assured.

Forms returned same day received.

Badger Electrotype Co.
600 Montgomery Bldg.
407 East Michigan St., Milwaukee, Wis.

Directory of Manufacturers' Products

This directory is published as a convenient guide to sources of supply covering the products of manufacturers carrying specification data in the ANNUAL NUMBER. For alphabetical index of manufacturers' specifications see page 131. To obtain products not included in this directory, quotations or additional information to help you make up your specifications, lists of equipment, etc., address Industrial-Arts Service Division.

ABRASIVES, Cloth, Disks & Paper
Carborundum Company, 31

ACID SWABS AND BRUSHES
Dixon, Inc., Wm., 30

ADJUSTABLE CURVE RULERS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

AMMETERS
General Electric Co., 111
Weston Electric Instrument Corp., 113

ANVIL TOOLS
Stanley Rule & Level Plant, 71, 73

ARC-WELDING SETS & EQUIP.
General Electric Co., 111

ART METAL TOOLS
Dixon, Inc., William, 30
Metal Crafts Supply Co., 103

ASBESTOS SOLDERING BLOCKS
Dixon, Inc., William, 30

AWLS, TINNERS'
Stanley Rule & Level Plant, 71, 73

BABBITT FURNACES
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95

BAND SAW BLADES
Simonds Saw & Steel Co., 88

BAND SAW BRAZERS, Electric
Oliver Machinery Co., 85

BAND SAWS
American Saw Mill Machinery Co., 74, 75
Fay & Egan Co., J. A., 130
Delta Specialty Co., 87
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

BAND SAWS, PORTABLE
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Oliver Machinery Co., 85
Walker-Turner Co., Inc., 89
Wallace & Co., J. D., 91

BASKETRY SUPPLIES
American Reedcraft Corp., 130
National Crafts Supply Co., 126

BATTERY CHARGERS
General Electric Co., 111

BENCH FURNACES
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95
Johnson Gas Appliance Co., 92

BENCH HEADS
Wisconsin Abrasive Co., 126

BENCH LEGS, METAL
New Britain Machine Co., 80, 81

BENCH VISES
Bemis, A. L., 130
Columbian Vise & Mfg. Co., 77
Morgan Vise Co., 101
Oliver Machinery Co., 85

BENCHES, MANUAL TRAINING
Bemis, A. L., 130
New Britain Machine Co., 80, 81

BENCHES, STAKE PLATE
New Britain Machine Co., 80, 81

BIT HOLDERS, EXTENSION
Stanley Rule & Level Plant, 71, 73

BITS, AUGER
Stanley Rule & Level Plant, 71, 73

BITS, SCREW DRIVER
Stanley Rule & Level Plant, 71, 73

BLACKBOARD DRAWING SETS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

BLOW PIPES, Brazing, Jewelers'
American Gas Furnace Co., 97
Dixon, Inc., William, 30

BLOWTORCHES
American Gas Furnace Co., 97
Dixon, Inc., William, 30

BLOWERS, FORGE
Chicago Flexible Shaft Co., 94, 95

BLUE-PRINTING MACHINES, ELECTRIC
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

BLUE-PRINT PAPER
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

BOARDS, DRAWING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

BOATS, MODEL
Liberty Playthings, 126

BOOKS
Bruce Publishing Company, The, 133, 3rd Cover
International Textbook Co., 105
McGraw-Hill Book Co., Inc., 115

BORERS, WOOD
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

BOW COMPASSES, DIVIDERS, PENS, PENCILS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

BRACES
Stanley Rule & Level Plant, 71, 73

BRAD AWLS
Stanley Rule & Level Plant, 71, 73

BRASS FURNACES, GAS
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95

BRASS TYPE
American Type Founders Co., 123

BRAYERS
American Type Founders Co., 123

BRAZING TORCHES
American Gas Furnace Co., 97

BRISTOL BOARD
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

BRUSHES, ARTISTS'
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

BRUSHES, CIRCULAR, BRISTLE AND WIRE (All Kinds)
Dixon, Inc., William, 30
Standard Electrical Tool Co., 99

BRUSH MAKING MATERIALS
E. B. & A. C. Whiting, 128

BUFFERS, BENCH, PEDESTAL
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

BUFFS, POLISHING
Dixon, Inc., William, 30

BURNERS, Bunsen or Laboratory
Dixon, Inc., William, 30
Johnson Gas Appliance Co., 92

BURNERS, GAS
American Gas Furnace Co., 97
Johnson Gas Appliance Co., 92

BUSHING REMOVERS
Snap-On Tools, Inc., 107, 109

CABINETS FILING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

CABINETS, CUT AND ELECTRO
American Type Founders Co., 123

CABINETS, Furniture, Galleys, Ink, Type, and Rollers
American Type Founders Co., 123

CARBURIZING OR CASE HARDENING COMPOUNDS
Johnson Gas Appliance Co., 92

CARVED WOOD MOULDINGS
Kline Manufacturing Co., 86

CEMENTS, JEWELERS'
Dixon, Inc., William, 30

CHARCOAL BLOCKS
Dixon, Inc., William, 30

CHARGERS, BATTERY
General Electric Company, 111

CHASES
American Type Founders Co., 123

CHASING TOOLS
Dixon, Inc., William, 30
Metal Crafts Supply Co., 103

CHISELS, Cape, Cold, Grooving
Snap-On Tools, Inc., 107, 109
Stanley Rule & Level Plant, 71, 73

CHISELS, FRAMING, MORTISE
Stanley Rule & Level Plant, 71, 73

CHISELS, TURNING
Stanley Rule & Level Plant, 71, 73

CHUCKS, Independent, Universal, Combination
Rockford Machine Tool Co., 92
South Bend Lathe Works, 130

CHUCKS, DRILL
South Bend Lathe Works, 130

CIRCULAR-SAW BENCHES
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Walker-Turner Co., Inc., 89
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

CLAMPS
Adjustable Clamp Co., 105
Columbian Vise & Mfg. Co., 77

CLAMPS, ADJUSTABLE
Adjustable Clamp Co., 105

CLAMPS, BAR
Adjustable Clamp Co., 105
Oliver Machinery Co., 85

CLAMPS, CARRIAGE, SCREW
Adjustable Clamp Co., 105
Columbian Vise & Mfg. Co., 77
Oliver Machinery Co., 85

COMBINATION FILING CABINETS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

COMPOSING STICKS
American Type Founders Co., 123
Rouse & Co., H. B., 116

COMPRESSOR AND LIFTER, VALVE SPRING
Snap-On Tools, Inc., 107, 109

CONDUIT FITTINGS
General Electric Co., 111

CONDUITS
General Electric Co., 111

CONDUITS, FLEXIBLE
General Electric Co., 111

CONTROLLERS, ELECTRIC
General Electric Co., 111

COPING SAW BLADES
Simonds Saw & Steel Co., 88
Ruleta Co., The, 128

COPING SAWS
Delta Specialty Co., 87
Foley Manufacturing Co., 88
Walker-Turner Co., Inc., 89

CORE OVENS
Johnson Gas Appliance Co., 92

COTTER-PIN EXTRACTORS
Snap-On Tools, Inc., 107, 109

COUNTERSINKS
Stanley Rule & Level Plant, 71, 73

CRUCIBLES, Graphite and Sand
Dixon, Inc., William, 30

CURVES, IRREGULAR
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

CUTAWL
International Register Co., 86

CUT-OFF SAWS
American Saw Mill Machinery Co., 74, 75
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

CUTTER HEADS
Yates-American Machine Co., 82, 83

CUTTING NIPPERS
Snap-On Tools, Inc., 107, 109

CYLINDER PRINTING PRESSES
American Type Founders Co., 123

DADO HEADS
Delta Specialty Co., 87
Simonds Saw & Steel Co., 88
Yates-American Machine Co., 82, 83

DESKS, TEACHERS', METAL
New Britain Machine Co., 80, 81

DIE MAKERS' SUPPLIES
Dixon, Inc., William, 30

DISTRIBUTION TRANSFORMERS
General Electric Co., 111

DOWEL POINTERS
Stanley Rule & Level Plant, 71, 73

DOWELING JIGS
Stanley Rule & Level Plant, 71, 73

DRAFTING PENS
Dietzgen Co., Eugene, 118, 119

DRAFTING TABLES
Dietzgen Co., Eugene, 118, 119
New Britain Machine Co., 80, 81
Post Company, Frederick, 121
U. S. Blue Co., 126

DRAFTSMENS' INSTRUMENTS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

DRAW PLATES
Dixon, Inc., William, 30

DRAWING-INSTRUMENT REPAIR PARTS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

DRAWING OUTFITS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

DRAWING PAPER IN ROLLS AND SHEETS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

DRAWING TABLES
Dietzgen Co., Eugene, 118, 119
New Britain Machine Co., 80, 81
Post Company, Frederick, 121
U. S. Blue Co., 126

DRESSERS, EMERY AND GRINDING WHEEL
Standard Electrical Tool Co., 99

DRILL PRESSES
Delta Specialty Co., 87
Porter Cable-Hutchinson Corp., 79

DRILL STANDS, BENCH, POST, PEDESTAL
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

DRILLING MACHINES, PORTABLE ELECTRIC
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

DRILLS, BENCH AND FLOOR, HIGH SPEED
Delta Specialty Co., 87
Walker-Turner Co., 89

DRILLS, BREAST
Stanley Electric Tool Co., 71, 73

DYNOMETERS, ELECTRIC
General Electric Co., 111

ELECTRIC ARC-WELDING EQUIPMENT & SUPPLIES
General Electric Co., 111

ELECTRIC GENERATORS
General Electric Co., 111

ELECTRIC MOTORS
Louis Allis Co., 92
General Electric Co., 111

ELECTRICAL INSTRUMENTS
General Electric Co., 111
Weston Electric Instrument Corp., 113

ELECTROTYPES
Badger Electrotype Co., 126

EMERY POWDER
Dixon, Inc., William, 30

ENGRAVERS' TOOLS AND SUPPLIES
Dixon, Inc., William, 30
Metal Crafts Supply Co., 103

ENVELOPES
Western States Envelope Co., 125

ENVELOPES, Baronial, Catalog, Clasp, Commercial, Window
Western States Envelope Co., 125

ERASERS, Combination
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

FEEDERS, Automatic (Printing)
American Type Founders Co., 123

FELT WHEELS AND BUFFS
Dixon, Inc., William, 30

FIBRE CORD
Grand Rapids Fibre Cord Co., 105

FILES AND RASPS
Nicholson File Co., 34
Simonds Saw & Steel Co., 88

FILING CASES
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

FILING MACHINES
Dixon, Inc., William, 30

FIRE BRICK AND CEMENT
Chicago Flexible Shaft Co., 94, 95
Johnson Gas Appliance Co., 92

FIRE CLAY
Chicago Flexible Shaft Co., 94, 95
Johnson Gas Appliance Co., 92

FLEXIBLE SHAFT AND MOTOR OUTFITS
Dixon, Inc., William, 30

FLEXIBLE STEEL TAPE RULES
Dietzgen Co., Eugene, 118, 119
Master Rule Mfg. Co., 128
Post Company, Frederick, 121
U. S. Blue Co., 126

FLEXIBLE TUBING AND CONDUITS
General Electric Co., 111

FLINT PAPER
Carborundum Company, 31

FLOOR SANDERS
Porter-Cable-Hutchinson Corp., 79

FLUX, SOLDERING
Dixon, Inc., William, 30
Kester Solder Co., 103

FOLDING RULES
Master Rule Mfg. Co., 128
Stanley Rule & Level Plant, 71, 73

FORGE TOOLS
Stanley Rule & Level Plant, 71, 73

FORGES, GAS
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95
Johnson Gas Appliance Co., 92

FREQUENCY METERS Portable and Switchboard
Weston Electric Instrument Co., 113

FURNACE LININGS
Carborundum Company, 31

FURNACES, Annealing, Case-Hardening, Heat Treating, Metal Melting, Soldering, and Tempering
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95
General Electric Co., 111
Johnson Gas Appliance Co., 92

FURNACES, FORGING
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95
Johnson Gas Appliance Co., 92

FURNITURE TRIM
Kline Manufacturing Co., 86

FURNITURE WEAVING FRAMES
Grand Rapids Fibre Cord Co., 105

FUSES, STANDARD
General Electric Co., 111

GALVANOMETERS
General Electric Co., 111
Weston Electric Instrument Corp., 113

GARNET PAPER
Carborundum Company, 31

GASKET FILLER
Pep Mfg. Co., 128

GAUGES, CABINET, RULE AND SQUARE
Stanley Rule & Level Plant, 71, 73

GAUGES, BIT
Stanley Rule & Level Plant, 71, 73

GAUGES, CALIPER
Dixon, Inc., William, 30

GAUGES, MARKING
Stanley Rule & Level Plant, 71, 73

GAUGES, THICKNESS AND THREAD
Snap-On Tools, Inc., 107, 109

GEAR PULLERS
Snap-On Tools, Inc., 107, 109

GENERATOR TEST BENCHES
General Electric Co., 111

GLUE
M. L. Campbell Co. 128
Casein Manufacturing Co., 126
Chas. M. Higgins & Co., 120

GLUE POTS, ELECTRIC
General Electric Co., 111
Oliver Machinery Co., 85
Russell Electric Co., 126
Wallace & Co., J. D., 91

GOUGES
Stanley Rule & Level Plant, 71, 73

GRAVERS
Dixon, Inc., William, 30

GRINDERS AND BUFFERS, PORTABLE ELECTRIC
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

GRINDERS, BENCH
Mummert-Dixon Co., 103
Rockford Machine Tool Co., 92
Standard Electric Tool Co., 99
Stanley Electric Tool Co., 71, 73
Wisconsin Abrasive Co., 126

GRINDERS, OILSTONE
Mummert-Dixon Co., 103
Wallace Co., J. D., 91

GRINDERS, PEDESTAL TYPE
Carter Co., R. L., 33
Fay & Egan Co., J. A., 130
Mummert-Dixon Co., 103
Porter-Cable-Hutchinson Corp., 79
Rockford Machine Tool Co., 92
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

GRINDING COMPOUND
Pep Mfg. Co., 128

GRINDING MACHINES, INTERNAL AND EXTERNAL
Standard Electrical Tool Co., 99

GRINDING MACHINES, SURFACE
Standard Electrical Tool Co., 99

GRINDING WHEELS
Carborundum Co., 31
Wisconsin Abrasive Co., 126

HACKSAW BLADES
Simonds Saw & Steel Co., 88

HAMMERS
Dixon, Inc., William, 30
Lussky, White & Coolidge, Inc., 116
Stanley Rule & Level Plant, 71, 73

HAMMERS, BALL-PEEN CROSS-PEEN, SLEDGE
Snap-On Tools, Inc., 107, 109
Stanley Rule & Level Plant, 71, 73

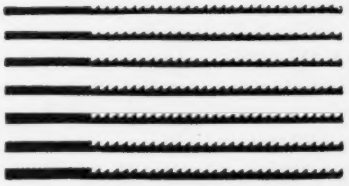
HAMMERS, BLACKSMITH
Stanley Rule & Level Plant, 71, 73

(Continued on Page 129)

The School Shop Shopping Guide

FRET OR SCROLL SAW BLADES

For Wood, Bone, Celluloid, Fibre, Metals, etc.



Ruleta Saw Blades are all made with Filed Teeth, with Round Back for easy turning OIL HARDENED AND TEMPERED. They cut fast and clean.

Over three hundred (300) styles and sizes for metals, wood, celluloid, Bakelite, paper, bone, pearl, ivory, etc.

Fret Saws	Jewelers' Saws
Jig Saws	Puzzle Saws
Scroll Saws	Coping Saws

Send for catalogue and tell us your problem, and we will recommend the proper saw. Samples on request.

THE RULETA CO., INC.
91 Warren St., New York, N. Y.

PEWTER
AND BRITANNIA METAL

Sheets: 24"x36" or smaller
Circles: 2" to 24" diameter
Specify size and gauge.

NATIONAL LEAD CO., DEPT. P
New York Chicago St. Louis

FREE SAMPLES

for teachers of auto mechanics and their students

Teachers: How many students have you?

Write
PEP MFG. CO.
INCORPORATED
33 W. 42nd St.
New York

Essentials of Applied Electricity
PRICE, $1.36 *By* E. W. JONES
A sound presentation of the elementary laws of electricity and their application.
The Bruce Publishing Co. — Milwaukee

STOPS LEAKS—MAKES LOOSE PARTS TIGHT

SMOOTH-ON NO. 1 stops leaks of water, steam, oil, gas, smoke. Makes a pressure-tight seal at joints, cracks or breaks in pipes, boilers, radiators, tanks, pails, etc. Makes loose handles, nuts, bolts, screws tight. Stops leaks in auto radiators, cracked water jackets, keeps nuts and hub caps tight. Applied cold. Holds in metal, tile, wood, concrete.

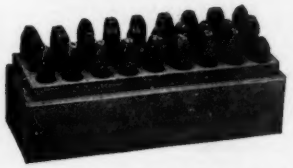
Write for Free Instruction Book

Get Smooth-On No. 1 in 7-oz. or 1 or 5-lb. can from any hardware store.

Smooth-On Mfg. Co.,
Dept. 75, 570 Communipaw Ave.
Jersey City, N. J.

Do it with SMOOTH-ON

STEEL STAMPS
Alphabet and Figure Sets



Special Steel Stamps for marking tools, or equipment. Made to order.

Catalog sent on request

The Schwaab Stamp & Seal Co.
547 N. Water St. Milwaukee, Wis.

INSTRUCTION SHEETS

UNIT SERIES I. WOODWORKING—Ten Instruction Sheets (Black on White Prints) on common operations.
INTERMEDIATE PROJECT SERIES VIII—Six Projects on Ten Sheets. Table Lamp, Smoking Stand, End Table, Pier Cabinet, Book Case, Priscilla Sewing Cabinet. New Designs. $.35 per set, 4 sets $1.00, 10 sets $2.00. May split sets. Prices too low to be able to send samples. Money order preferred.
Clifford B. Smith, 294 Hastings St., Buffalo, N. Y.

FINISHING SUPPLIES

Stick Shellac—Waxes—Lacquer—Varnishes—Stains—Glue—Remover—Campbell Finishes and Repair Specialties are used by Furniture and Piano Finishers everywhere.

Ask for catalog and descriptive literature

THE M. L. CAMPBELL CO.
2906 East 13th St. Kansas City, Mo.

JIGSAW PUZZLE SUPPLIES

We are supply headquarters for puzzle enthusiasts throughout the country. Special Plywoods, stainless glue, boxes, saw blades, special garden patterns. Send 3c for list.

Complete Supplies at Unbeatable Prices

H. L. WILD
Dept. B3, 519 E. 11 St., New York, N.Y.

INLAY—THE ART OF INLAYING IS A NECESSARY PART OF A COURSE IN WOODWORKING.

Pamphlet on history and method of inlaying with complete catalogue of designs and 60 actual samples. Special to schools—25c (regular $1.00), refunded with orders.

Marqueterie Corporation
192 Lexington Ave. New York, N. Y.

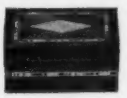
TRAINING TEACHERS
Attention!

Selley's new educational airplane control kit — The Junior Airplane-Control Trainor — a highly practical model of the controls on all flying machines.
School Instructors save time. The Junior Trainor eliminates necessity of sketches and drawings and simplifies the demonstration of theories because it ACTUALLY WORKS.
The JUNIOR TRAINOR is designed in such a manner that it can be mounted on a rigid base or on a ball and socket joint.

Price Per Kit, $2.25, Postpaid

SELLEY MANUFACTURING CO.
1377-A Gates Ave. Brooklyn, N.Y.

NOW IT'S EASY TO INLAY WOOD—



The above illustrates one of many projects for which complete inlay is furnished, with or without box.

"INTARSIA CRAFT"
(Not a Transfer)

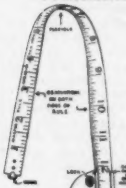
Genuine, natural woods are used. A hot flat iron, a sharp knife and sandpaper are your tools.
A master's skill now possible to EVERYONE.

Send for List of Projects and Prices

WM. A. GILLIES PROCESS
3258 N. Downer Ave., Milwaukee, Wis.

MASTER FLEXIBLE STEEL Tape Rule

A mechanical achievement of unique design for measuring:



INSIDE » « OUTSIDE
HEIGHT » « DEPTH
CALIPER and around FLEXIBLE OBJECTS
Useful for LAYOUTS and MARKING
6 SPECIAL DESIGN FEATURES

By the makers of Interlox Slide Rule and Blue End Folding Rules

WRITE FOR CIRCULAR
MASTER RULE MFG. CO.
819 E. 136th St. New York, N. Y.
Work Faster with a Master

Materials for Brush Making

Brush Fibres, Tampico, Fibre Mixtures, Sterilized Horse Hair, Hair, Bristle and Tampico mixtures solid or taper stock, original lengths cut to size. *Samples matched.*

E. B. & A. C. WHITING CO.
Burlington, Vermont

APPLIED ARCHITECTURAL DRAWING .. *T. R. Abercrombie*

A fundamental course in architectural drawing that teaches correct drafting-room practice and applies that knowledge to practical problems. *$2.00.*

The Bruce Publishing Co. Milwaukee, Wis.

Directory of Manufacturers' Products, Continued

HAMMERS, LEAD AND SOFT FACE
Dixon, Inc., William, 30
Snap-On Tools, Inc., 107, 109

HAMMERS, NAIL
Lussky, White & Coolidge, Inc., 116
Stanley Rule & Level Plant, 71, 73

HAMMERS, PORTABLE ELECTRIC
Stanley Electric Tool Co., 71, 73

HANDICRAFT SUPPLIES
Fellowcrafters, Inc., 126

HAND SAWS, PORTABLE ELECTRIC
Stanley Electric Tool Co., 71, 73

HAND SCREWS
Adjustable Clamp Co., 105

HARDIES
Stanley Rule & Level Plant, 71, 73

HEAT-FLOW METERS
Weston Electric Instrument Corp., 113

HEAT-TREATING EQUIPMENT
American Gas Furnace Co., 97
Chicago Flexible Shaft Co., 94, 95
Johnson Gas Appliance Co., 92

INDICATORS, DEMAND
General Electric Co., 111

INDICATING INSTRUMENTS, ELECTRIC
General Electric Co., 111
Weston Electric Instrument Corp., 113

INK REMOVERS
Dietzgen Co., Eugene, 119, 119
Post Company, Frederick, 121

INKS, DRAWING AND COLORED
Dietzgen Co., Eugene, 118, 119
Higgins & Co., Chas M., 120
Post Company, Frederick, 121
U. S. Blue Co., 126

INKS, PRINTING
American Type Founders Co., 123

INLAY
Gillies, Wm. A., Process, 128
Marqueterie Corp., 128

IRON CEMENT
Smooth-On Mfg. Co., 128

JACKETS, SNAP, FLASK, AND MOLD
Oliver Machinery Co., 85

JEWELERS' TOOLS, EQUIPMENT AND SUPPLIES
Dixon, Inc., William, 30

JIG SAW BLADES
The Ruleta Co., 128
Simonds Saw & Steel Co., 88
H. L. Wild, 128

JIG SAW PUZZLE SUPPLIES
H. L. Wild, 128

JIG SAWS
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Foley Manufacturing Co., 88
International Register Co., 86
Oliver Machinery Co., 85
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

JOINTERS
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

JOINTERS, BENCH
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Walker-Turner Co., Inc., 89
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

JOINTERS, HAND
Delta Specialty Co., 87
Yates-American Machine Co., 82, 83

KNIVES, Sloyd, Manual Training, Stencil and Wood Block
Robt. Murphy's Sons Co., 116

KNIVES, MACHINE
Simonds Saw & Steel Co., 88
Yates-American Machine Co., 82, 83

KNIVES, PAPER CUTTER
American Type Founders Co., 123
Simonds Saw & Steel Co., 88

KNOCK-DOWN FURNITURE
Thurston Supply Co., 86

LABORATORY STANDARD INSTRUMENTS
Weston Electric Instrument Corp., 113

LAMPS, ALCOHOL
Dixon, Inc., William, 30

LAMPS, MINIATURE
General Electric Co., 111

LATHE ATTACHMENTS
South Bend Lathe Works, 130

LATHES, BENCH, METAL WORKING
South Bend Lathe Works, 130

LATHES, METAL WORKING
Rockford Machine Tool Co., 92
South Bend Lathe Works, 130

LATHES, SMALL PRECISION
Dixon, Inc., William, 30

LATHES, WOODWORKING
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Walker-Turner Co., Inc., 89
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

LEAD AND RULE CUTTERS
American Type Founders Co., 123
H. B. Rouse & Co., 116

LEATHER
W. A. Hall, 130
National Crafts Supply Co., 126

LEATHER WORKING TOOLS AND SUPPLIES
W. A. Hall, 130
National Crafts Supply Co., 126

LETTERS AND FIGURES FOR STAMPING METALS
Dixon, Inc., William, 30
Schwaab Stamp & Seal Co., 128

LEVELS
Stanley Rule & Level Plant, 71, 73

LINOLEUM AND RUBBER BLOCKS AND ENGRAVING TOOLS
American Type Founders Co., 123
National Crafts Supply Co., 126

LOOM CLAMPS
General Electric Co., 111

LUMBER
Hartley Akin Lumber Co., 130
W. W. Brust, 130
T. A. Foley Lumber Co., 130
W. O. King Lumber Co., 130
The O'Brien Lumber Co., 130
Frank Paxton Lumber Co., 130

MACHINE KNIVES, JOINTER AND SURFACER
Simonds Saw & Steel Co., 88
Yates-American Machine Co., 82, 83

MACHINE STANDS
New Britain Machine Co., 80, 81

MALLETS, HICKORY, RUBBER, RAWHIDE
American Type Founders Co., 123
Dixon, Inc., William, 30
Stanley Rule & Level Plant, 71, 73

MANUAL-TRAINING HARDWARE
Gross Hardware, 126
Lussky, White & Coolidge, Inc., 116
Thurston Supply Co., 86

MANUAL-TRAINING TOOLS AND SUPPLIES
Gross Hardware, 126
Lussky, White & Coolidge, Inc., 116
Stanley Rule & Level Plant, 71, 73
Thurston Supply Co., 86

MANUAL-TRAINING VISES
A. L. Remis, 130
Columbian Vise & Mfg. Co., 77
Morgan Vise Co., 101

MEASURING INSTRUMENTS, ELECTRIC
General Electric Co., 111
Weston Electric Instrument Corp., 113

MELTING POT EQUIPMENT
American Gas Furnace Co., 97
General Electric Co., 111

METAL CRAFT TOOLS AND SUPPLIES
Wm. Dixon, Inc., 30
Metal Crafts Supply Co., 103
National Crafts Supply Co., 126

METAL SHEARS, ELECTRIC
Stanley Electric Tool Co., 71, 73

METAL TOOL BOXES
New Britain Machine Co., 80, 81
Snap-On Tools, Inc., 107, 109

METALS, SHEET
Dixon, Inc., William, 30
Metal Crafts Supply Co., 103

METRIC SCALES, FLAT
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

MICA
General Electric Co., 111

MICROFARAD METERS
Weston Electric Instrument Corp., 113

MITER BOXES
Stanley Rule & Level Plant, 71, 73

MITERING MACHINES, HAND AND POWER (Printing)
American Type Founders Co., 123
H. B. Rouse & Co., 116

MODEL AIRPLANES, PARTS AND SUPPLIES
Selley Manufacturing Co., 128

MODEL BOATS
Liberty Playthings, 126

MORTISERS
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

MORTISERS, CHAIN
New Britain Machine Co., 80, 81

MOTOR GENERATOR SETS
General Electric Co., 111

MOTORS, ELECTRIC
Louis Allis Co., 92
General Electric Co., 111

NUMBERING MACHINES
American Type Founders Co., 133

OHMMETERS, PORTABLE
Weston Electric Instrument Corp., 113

OILSTONE TOOL GRINDER
Mummert-Dixon Co., 103
Oliver Machinery Co., 85
Wallace Co., J. D., 91

OUTLETS, SWITCHBOXES
General Electric Co., 111

OZALID PAPER
Dietzgen Co., Eugene, 118, 119

PAGE FRAMES
H. B. Rouse & Co., 116

PANEL BOARD, ELECTRIC
General Electric Co., 111

PANS, PICKLE OR ACID
Dixon, Inc., William, 30

PANTOGRAPHS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

PAPER, CLOTH-BACKED
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

PAPER, DETAIL, RULED
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

PAPER, DRAWING AND TRACING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

PAPER CUTTERS
American Type Founders Co., 123

PASTE
Chas. M. Higgins & Co., 120

PENCILS, PLAIN, COLORED, DRAWING, WORKING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

PENS, INK SHADING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

PENS, LETTERING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

PEWTER
National Lead Co., 128

PHASE ANGLE METERS
Weston Electric Instrument Corp., 113

PICTURE FRAME TOOLS
Stanley Rule & Level Plant, 71, 73

PLANERS AND SURFACERS (WOOD)
American Saw Mill Machinery Co., 74, 75
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Wallace Co., J. D., 91
Yates-American Machine Co., 82, 83

PLANES, HAND
Stanley Rule & Level Plant, 71, 73

PLASTIC WOOD
A. S. Boyle Co., 130

PLATEN PRESSES
American Type Founders Co., 123

PLATING SOLUTIONS
Dixon, Inc., William, 30

PLIERS
Dixon, Inc., William, 30
Snap-On Tools, Inc., 107, 109

PLIERS, COMBINATION
Snap-On Tools, Inc., 107, 109

PLIERS, Flat Nose, Round Nose, Side Cutting
Snap-On Tools, Inc., 107, 109

POLISHERS, PORTABLE ELECTRIC
Standard Electrical Tool Co., 99

POLISHING COMPOSITIONS AND POWDERS
Dixon, Inc., William, 30

PORCELAIN KNOBS, CLEATS, ETC.
General Electric Co., 111

PORTABLE METERS, INDICATING
General Electric Co., 111
Weston Electric Instrument Corp., 113

PORTABLE WOODWORKING MACHINERY
Delta Specialty Co., 87
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Walker-Turner Co., 89
Wallace Co., J. D., 91
Yates-American Machine Co., 82, 83

PRESSES, VENEER
Yates-American Machine Co., 82, 83

PRINTERS' ENVELOPE SERVICE
Western States Envelope Co., 135

PRINTERS' ROLLERS
American Type Founders Co., 123

PRINTING PRESS CONTROLS
General Electric Co., 111

PRINTING PRESS MOTORS
Allis Co., Louis, 92
General Electric Co., 111

PRINTING PRESSES
American Type Founders Co., 123

PRINTSHOP EQUIPMENT AND SUPPLIES
Globe Type Foundry, 126
American Type Founders Co., 123
H. B. Rouse & Co., 116

PROJECT INSTRUCTION SHEETS
Clifford B. Smith, 128

PROOF PRESSES
American Type Founders Co., 123

PROTRACTORS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 130

PUBLISHERS
Bruce Publishing Company, The, 132, 3rd Cov.
International Textbook Co., 105
McGraw-Hill Book Co., Inc., 115

PULLERS, WHEEL
Snap-On Tools, Inc., 107, 109

PUNCHES, CENTER, PRICK AND SOLID
Snap-On Tools, Inc., 107, 109
Stanley Rule & Level Plant, 71, 73

RADIO TEST EQUIPMENT
Weston Electric Instrument Corp., 113

REAMERS, VALVE SEAT
Snap-On Tools, Inc., 107, 109

RECEPTACLES, CLEAT, MEDIUM BASE, OR MINIATURE
General Electric Co., 111

RECEPTACLES, DUPLEX PLATE AND SIGN
General Electric Co., 111

REDUCING GLASS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

RESISTANCE BOXES, PLUG AND DIAL
Weston Electric Instrument Corp., 113

REVOLUTION COUNTERS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

RHEOSTATS
General Electric Co., 111

ROUGES, POLISHING
Dixon, Inc., William, 30

ROUTERS, PORTABLE AND STATIONARY
Carter Co., R. L., 32

RUBBER STAMPS
Schwaab Stamp & Seal Co., 128

RUBBER TYPE SETS
Schwaab Stamp & Seal Co., 128

RULES, WOOD, BOXWOOD AND COMBINATION
Dietzgen Co., Eugene, 118, 119
Master Rule Mfg. Co., 128
Post Company, Frederick, 121
Stanley Rule & Level Plant, 71, 73
U. S. Blue Co., 126

SANDERS, BELT
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Yates-American Machine Co., 82, 83

SANDERS, COMBINATION
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Walker-Turner Co., Inc., 89
Yates-American Machine Co., 82, 83

SANDERS, DISK
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Standard Electrical Tool Co., 99
Wallace & Co., J. D., 91

SANDERS, DRUM
Fay & Egan Co., J. A., 130
Yates-American Machine Co., 82, 83

SANDERS, PORTABLE
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Standard Electrical Tool Co., 99

SANDERS, SPINDLE
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
J. D. Wallace & Co., 91
Yates-American Machine Co., 82, 83

SANDPAPER
Carborundum Company, 31

SAW BENCHES, CIRCULAR
(See Circular-Saw Benches)

SAW BOXES, MITER
Stanley Rule & Level Plant, 71, 73

SAW FILING MACHINES
Foley Manufacturing Co., 88

SAW SETS
Stanley Rule & Level Plant, 71, 73

SAW TRIMMERS (PRINTING)
American Type Founders Co., 123
H. B. Rouse & Co., 116

SAWS, CIRCULAR, BAND AND HACK
Simonds Saw & Steel Co., 88

SAWS, PORTABLE ELECTRIC
Stanley Electric Tool Co., 71, 73

SCALES, PRECIOUS METAL AND DIAMOND
Dixon, Inc., William, 30

SCRAPERS, HAND AND CABINET
Stanley Rule & Level Plant, 71, 73

SCREW CLAMPS
Adjustable Clamp Co., 105
Columbian Vise & Mfg. Co., 77

SCREW DRIVERS
Snap-On Tools, Inc., 107, 109
Stanley Rule & Level Plant, 71, 73

SCREW DRIVERS, ELECTRIC
Stanley Electric Tool Co., 71, 73

SEALS
Schwaab Stamp & Seal Co., 128

SCROLL SAWS
Delta Specialty Co., 87
Foley Manufacturing Co., 88
International Register Co., 86
Walker-Turner Co., 89
Wallace & Co., J. D., 91

SEMI-PRECIOUS STONES
Metal Crafts Supply Co., 103

SHAPER PLANERS, METAL WORKING
Rockford Machine Tool Co., 92

SHAPERS, ELECTRIC
Carter Co., R. L., 32

SHAPERS, METAL
Rockford Machine Tool Co., 92

SHAPERS, WOODWORKING
American Saw Mill Machinery Co., 74, 75
Carter Co., R. L., 32
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

SHARPENING STONES
Carborundum Company, 31

SILVERSMITHS' TOOLS AND SUPPLIES
Dixon, Inc., William, 30
Metal Crafts Supply Co., 103

SKETCH BLOCKS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

SLIDE RULES
Dietzgen Co., Eugene, 118, 119
Master Rule Mfg. Co., 128
Post Company, Frederick, 121

SLOYD KNIVES
Robt. Murphy's Sons Co., 105

SOCKETS AND RECEPTACLES
General Electric Co., 111

SOLDER, Acid Core, Flux Core, Paste Core, Rosin Core
Kester Solder Co., 103

SOLDERING COPPERS
Dixon, Inc., William, 30
Johnson Gas Appliance Co., 92
Kester Solder Co., 103

SOLDERING FURNACES
Chicago Flexible Shaft Co., 94, 95
General Electric Co., 111
Johnson Gas Appliance Co., 92

SOLDERING IRONS, ELECTRIC TRIC
General Electric Co., 111

SOLDERING TORCHES
American Gas Furnace Co., 97
Dixon, Inc., William, 30

SOLDERS, ALL KINDS
Dixon, Inc., William, 30
Kester Solder Co., 103

(Continued on Page 131)

LUMBER FOR SCHOOL SHOPS
Whatever your need—Walnut, Cherry, Mahogany, Maple, Oak and others.
Panels, Turnings, Cedar Chests, Inlays, Dowels, Decals, Hardware.
We can furnish lumber for projects in this and past issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.
Send for list "M"
W. W. BRUST
BOX 1094, HUNTINGTON, W. VA.

Frank Paxton Lumber Co.
Hardwoods « » Softwoods
Panels
Kansas City, Kansas

KING
Quality Manual Training Lumber
Northern and Southern Hardwoods
Air Dried or Kiln Dried
Write for Price List and Stock List
W. O. King Lumber Co.
2701 S. Damen St. Chicago, Ill.

BASKETRY SUPPLIES
PRIME REED, large assortment Colored Raffia, Chair Caning, and Weaving Supplies. Everything for the Handcraft Worker.
Catalogue on request
AMERICAN REEDCRAFT CORPORATION
130 Beekman Street New York City

WALNUT
The O'BRIEN LUMBER CO.
2655 S. ROBEY ST., CHICAGO
Operating our own kilns assures you of dryness. Deal with a house known a half century for Quality and Service.
DOMESTIC HARDWOODS
MAHOGANY

T. A. Foley Lumber Co.
We Furnish Schools With
Lumber, Panels, Dowels and Cedar Chests
PARIS, ILLINOIS

PLASTIC WOOD
FIRST AID TO CRAFTSMEN
FINEST FOR MODELING
Handles like soft putty—quickly hardens into wood you can carve, paint, turn, that holds nails and screws even better than most natural woods. For hiding nicks, correcting mistakes, sealing cracks—for making working models—there's nothing better than PLASTIC WOOD—first aid to industrial arts—comes in 9 colors and is sold by all paint, hardware and department stores. FREE—Write A. S. Boyle Co., Dept. IA-2, Cincinnati, Ohio, for big 48-page book crammed full of amazing uses for PLASTIC WOOD.

A Sloyd Bench that stands the test of time.

The Bemis Standard.
Send for circular.
A. L. BEMIS, 68 Commercial St., Worcester, Mass.

FOLLOW THROUGH!
Teach Students the woodworking trade—from dressing rough lumber to finished product—on the same type of equipment used in modern woodworking plants. In other words—
Fay-Egan WOODWORKING MACHINERY
Backed by over a century of manufacturing experience, and including exclusive advantages and improvements, these machines are the safest, most practical tools for the classroom ever built. That is why they are the choice of leading technical and vocational schools in the United States and foreign countries. Complete information gladly sent on request.
A Complete New Line of Precision Built Woodworking Machinery
J. A. FAY & EGAN COMPANY
2748-2848 Robertson Ave. Oakley, Cincinnati, O.

The master automotive trade text
AUTOMOTIVE SERVICE
Ray F. Kuns
By far, the most inclusive, most thoroughly illustrated, single volume ever to be published for students of automotive mechanics. It comprises some 1136 pages and includes over 1100 illustrations. Modern, detailed, understandable, it is the *one* automotive trade text you need.
Price, $6.50
The Bruce Publishing Company
524-544 N. Milwaukee St., Milwaukee, Wis.

Free Bulletins On Auto Servicing

Lathes for Auto Service Shops No. 36
How to Grind Valves No. 1
How to Service Armatures No. 2
How to Finish Pistons No. 9
How to Make Bushings No. 7
Auto Service Job Manuals No. 56
Machine Shop Course No. 55A
The Small General Shop No. 50
☐ No. 1 ☐ No. 2 ☐ No. 9 ☐ No. 7
No. 56 ☐ **SOUTH BEND LATHE WORKS**
137 East Madison St., South Bend, Ind., U. S. A.
Gentlemen: Please send one each of 12-page Bulletins checked, which are free to instructors.
No. 55A ☐ *Name*.....
Address.....
No. 50 ☐ *City*..... *State*.....
School.....

FANCY LEATHERS
For Craft Workers
A 5-cent stamp brings you samples
Sold by the whole or half skin, also cut to measure
Tools, designs, lacings, both in Calf and Goat skin, Snap Fasteners to match leathers, Leather Dye, Wax Polish, Sphinx Paste, Slide Fasteners and Bag Plates.
W. A. HALL
250 Devonshire St. Boston 9, Mass.

Directory of Manufacturer's Products, Continued

SPECIAL AUTO MECHANICS' TOOLS
Snap-On Tools, Inc., 107, 109

SPINDLE CARVERS
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Yates-American Machine Co., 82, 83

SPOKESHAVES
Stanley Rule & Level Plant, 71, 73

SQUARES, BEVEL
Stanley Rule & Level Plant, 71, 73

SQUARES, FRAMING
Stanley Rule & Level Plant, 71, 73

SQUARES, MITER
Stanley Rule & Level Plant, 71, 73

STAKES, ARTS AND CRAFTS
Dixon, Inc., William, 30

STAMPS, LETTERS AND FIGURES
Dixon, Inc., William, 30
Schwaab Stamp & Seal Co., 128

STANDARD CELLS
Weston Electric Instrument Corp., 113

STARTERS, MOTOR, ELECTRIC
General Electric Co., 111

STEEL RULES
Dietzgen Co., Eugene, 118, 119
Master Rule Mfg. Co., 128
Post Company, Frederick, 121

STEEL SQUARES
Dietzgen Co., Eugene, 118, 119
Master Rule Mfg. Co., 128
Post Company, Frederick, 121
Stanley Rule & Level Plant, 71, 73

STENCIL KNIVES
Murphy's Sons Co., Robt., 116

STICK SHELLAC
M. L. Campbell Co., 128

STOOLS
Dietzgen Co., Eugene, 118, 119
New Britain Machine Co., 80, 81
Post Company, Frederick, 121

STORAGE BATTERY TESTING INSTRUMENTS
Weston Electric Instrument Corp., 113

STUD REMOVER
Snap-On Tools, Inc., 107, 109

SWING SAWS
Wallace & Co., J. D., 91

SWITCHBOARDS
General Electric Co., 111
Weston Electric Instrument Corp., 113

SWITCHBOARD INSTRUMENTS, INDICATING
General Electric Co., 111
Weston Electric Instrument Corp., 113

SWITCHBOXES
General Electric Co., 111

SWITCHBOXES, OUTLET
General Electric Co., 111

SWITCHES, SAFETY
General Electric Co., 111

SWITCHES, SAFETY INCLOSED
General Electric Co., 111

SWITCHES, SNAP AND PUSH BUTTON, AND PLUG
General Electric Co., 111

TABLES, WELDING
New Britain Machine Co., 80, 81

TACHOMETERS, ELECTRIC
Weston Electric Instrument Corp., 113

TACKS, THUMBS, STEEL AND BRASS
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

TAPE, MEASURING
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121

TAPS AND DIES
Dixon, Inc., William, 30

T SQUARES
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

TEMPERING AND DRAWING SALTS
Chicago Flexible Shaft Co., 94, 95

TENONERS
American Saw Mill Machinery Co., 74, 75
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Yates-American Machine Co., 82, 83

TEST EQUIPMENT, ELECTRICAL
General Electric Co., 111
Weston Electric Instrument Corp., 113

THREAD-CUTTING TOOLS
South Bend Lathe Works, 130

TONGS
Dixon, Inc., William, 30
Stanley Electric Tool Co., 71, 73

TOOL AND CUTTER-GRINDER ATTACHMENTS
Mummert-Dixon Co., 103
Stanley Electric Tool Co., 71, 73

TOOL CHECKS
Schwaab Stamp & Seal Co., 128

TOOL GRINDERS, ELECTRIC
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

TOOL GRINDERS, OILSTONE
Oliver Machinery Co., 85
Mummert-Dixon Co., 103
Wallace Co., J. D., 91

TOOL HOLDERS
South Bend Lathe Works, 130

TOOL POST GRINDERS
South Bend Lathe Works, 130
Standard Electrical Tool Co., 99
Stanley Electric Tool Co., 71, 73

TOOL STANDS
New Britain Machine Co., 80, 81

TRACING PAPER AND CLOTH
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

TRANSFORMERS
General Electric Co., 111

TRIANGLES
Dietzgen Co., Eugene, 118, 119
Post Company, Frederick, 121
U. S. Blue Co., 126

TROWELS, PLASTERING, CEMENT, POINTING
Stanley Rule & Level Plant, 71, 73

TYPE FOUNDERS
American Type Founders Co., 123

TYPE GAUGES
H. B. Rouse & Co., 116

UNIVERSAL SAW BENCHES
American Saw Mill Machinery Co., 74, 75
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Yates-American Machinery Co.,

UPHOLSTERY MATERIALS AND SUPPLIES
Lussky, White & Coolidge, Inc., 116

VALVE GRINDING COMPOUND
Carborundum Company, 31

VALVE REGRINDERS
Snap-On Tools, Inc., 107, 109

VALVE-SPRING COMPRESSORS
Snap-On Tools, Inc., 107, 109

VARIETY SAW BENCHES
American Saw Mill Machinery Co., 74, 75
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Wallace & Co., J. D., 91
Yates-American Machine Co., 82, 83

VISE STANDS, PORTABLE AND STATIONARY
New Britain Machine Co., 80, 81

VISES, BENCH
A. L. Bemis, 130
Columbian Vise & Mfg. Co., 77
Morgan Vise Co., 101
Oliver Machinery Co., 85

VISES, BLACKSMITHS'
Columbian Vise & Mfg. Co., 77

VISES, MACHINE
Rockford Machine Tool Co., 92

VISES, PIPE
Columbian Vise Mfg. Co., 77
Morgan Vise Co., 101

VISES, WOODWORKERS'
A. L. Bemis, 130
Columbian Vise & Mfg. Co., 77
Morgan Vise Co., 101

VOLTMETERS
General Electric Co., 111
Weston Electric Instrument Corp., 113

WATERPROOF SANDPAPER
Carborundum Company, 31

WATTMETERS
General Electric Co., 111
Weston Electric Instrument Corp., 113

WEAVING MATERIALS, FURNITURE
Grand Rapids Fibre Cord Co., 105

WELDING EQUIPMENT, ELECTRIC
General Electric Co., 111

WELDING TORCHES
American Gas Furnace Mfg. Co., 97

WHEEL PULLERS
Snap-On Tools, Inc., 107, 109

WIRE NIPPERS
Snap-On Tools, Inc., 107, 109

WOOD CARVINGS
Klise Manufacturing Co., 86

WOOD FINISHING MATERIALS
M. L. Campbell Co., 128
Thurston Supply Co., 86

WOOD INLAY
Wm. A. Gillies Process, 128
Marqueterie Corp., 128

WOOD MOULDINGS
Klise Manufacturing Co., 86

WOOD TRIMMER
Oliver Machinery Co., 85

WOOD-TURNING LATHES
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79
Wallace & Co., J. D., 91
Walker-Turner Co., 89
Yates-American Machine Co., 82, 83

WOODWORKERS' VISES
Bemis, A. L., 130
Columbian Vise & Mfg. Co., 77
Morgan Vise Co., 101

WOODWORKING MACHINES, COMBINATION
American Saw Mill Machinery Co., 74, 75
Delta Specialty Co., 87
Fay & Egan Co., J. A., 130
Oliver Machinery Co., 85
Porter-Cable-Hutchinson Corp., 79

WOODWORKING SHAPERS
American Saw Mill Machinery Co., 74, 75
Oliver Machinery Co., 85
Yates-American Machine Co., 82, 83

WOODWORKING TOOLS AND SUPPLIES
Gross Hardware, 126
Lussky, White & Coolidge, Inc., 116
Stanley Rule & Level Plant, 71, 73
Thurston Supply Co., 86

WORK STANDS
New Britain Machine Co., 80, 81

WRENCHES, ADJUSTABLE
Snap-On Tools, Inc., 107, 109

WRENCHES, BOXOCKET
Snap-On Tools, Inc., 107, 109

WRENCHES, IGNITION
Snap-On Tools, Inc., 107, 109

WRENCHES, OPEN END
Snap-On Tools, Inc., 107, 109

WRENCHES, PIPE
Snap-On Tools, Inc., 107, 109

WRENCHES, RATCHET
Snap-On Tools, Inc., 107, 109

WRENCHES, RIGHT ANGLE
Snap-On Tools, Inc., 107, 109

WRENCHES, SOCKET
Snap-On Tools, Inc., 107, 109

WRENCHES, VALVE TAPPET
Snap-On Tools, Inc., 107, 109

Index to Advertisements

Adjustable Clamp Co. 105
Allis Co., The Louis..... 92
American Gas Furnace Company 97
American Saw Mill Machinery Company 74, 75
American Type Founders Company 123

Badger Electrotype Company...126
Bemis, A. L.....130
Boyle, A. S., Co.....130
Bruce Publishing Company..... .....132, 3rd Cover

Carborundum Company, The ... 31
Carter Company, The R. L..... 32
Casein Mfg. Company.....126
Chicago Flexible Shaft Company 94, 95
Columbian Vise & Mfg. Co..... 77

Delta Specialty Company 87
Dietzgen Company, Eugene.118, 119
Dixon, Inc., William 30

Fay & Egan Co., J. A.....130
Fellowcrafters, Inc. 126
Foley Manufacturing Company. 88

General Electric Company.....111
Gillies Process, Wm. A.....128
Grand Rapids Fibre Cord Co....105

Gross Hardware 126

Hall, W. A.....130
Higgins & Co., Chas. M.....120

International Register Co..... 86
International Textbook Co.....105

Johnson Gas Appliance Co..... 92

Kester Solder Company.....103
Klise Manufacturing Company.. 86

Liberty Playthings 126
Lumber Dealers 130
Lussky, White & Coolidge, Inc..116

McGraw-Hill Book Co., Inc.....115
Master Rule Mfg. Company....128
Metal Crafts Supply Company..103
Morgan Vise Company.....101
Mummert-Dixon Company 103
Murphy's Sons Co., Robert.....116

National Crafts Supply Company 126
New Britain Machine Company 80, 81
Nicholson File Company 34

Oliver Machinery Company..... 85

Pep Mfg. Company.....128
Porter-Cable-Hutchinson Corp.. 79
Post Company, Frederick.....121

Rockford Machine Tool Co..... 92
Rouse & Company, H. B.....116
Ruleta Company, Inc.....128
Russell Electric Company 126

School Shop Shopping Guide... .....126, 128, 130
Schwaab Stamp & Seal Co.....128
Selley Mfg. Company.....128
Simonds Saw & Steel Company. 88
Smooth-On Mfg. Company 128
Snap-On Tools, Inc.....107, 109
South Bend Lathe Works.....130
Standard Electrical Tool Co.... 99
Stanley Electric Tool Co..... 73
Stanley Rule & Level Plant.... 71

Thurston Supply Company 86

U. S. Blue Company.....126

Walker-Turner Co., Inc. 89
Wallace Company, J. D..... 91
Western States Envelope Company 125
Weston Electric Instrument Corp. 113
Wisconsin Abrasive Company ..126

Yates-American Machine Company 82, 83

The Bruce Publishing Company

524-544 No. Milwaukee Street, Milwaukee, Wisconsin

New York, N. Y.
40 E. 34th St.

Chicago, Ill.
66 E. South Water St.

Bruce Books for the School Shop

Woodwork

Elementary

Instructional Units in Hand Woodwork, by A. G. Brown, Department of Education, Stout Institute, Menomonie, Wisconsin, and F. E. Tustison, Head of Department of Home Mechanics, Stout Institute.

A splendid new text that describes, illustrates, and applies all the processes and tools employed in hand woodwork. Its unit construction sheet plan provides for adaptability to a variety of class conditions.

Cloth, 222 pages; 6 x 9". Price, $1.60.

Job Sheets in Practical Woodworking, by A. G. Brown and F. E. Tustison.

Job sheets presenting practical introductory course in hand tool woodwork. The essential principles and processes of hand tool woodwork are linked up with typical practical projects.

Loose Leaf, 31 jobs; 7¾ x 10¾". Price, 56c per set.

Job Sheets in Home Mechanics, I, by F. E. Tustison.

A group of thirty-nine principal home jobs. Excellent material on woodwork, wood finishing, general, sheet metal, bench metal, plumbing, electricity, and concrete. Jobs printed on loose-leaf sheets, can be inserted in standard binders.

Loose Leaf, 39 jobs; 7¾ x 10¾". Price, 64c per set.

Job Sheets in Home Mechanics, II, by F. E. Tustison.

Continuation of Job Sheets in Home Mechanics, I. Contains additional material in woodwork, general, sheet metal, electricity, bench metal, and plumbing.

Loose Leaf, 16 jobs; 7¾ x 10¾". Price, 36c per set.

American School Toys, Kunou.....$1.35
Toys Every Child Can Make, Wright..... 1.60
Boy Bird House Architecture, Baxter..... 1.00
Permanent Bird Houses, Califf..... 1.00
Easy-to-Make Toys, Kunou..... 1.44
Toy Craft, Baxter..... 1.30
Hand Work for Boys, Hughes..... 1.50
Hand Craft Projects, Books 1, 2, and 3..... 1.25 each
Manual of Gilding and Compo Work, Kunou..... 1.50
Model Boat Building for Boys, Cavileer..... 1.65
Problems in Woodwork, Worst..... 2.50
25 Kites That Fly, Hunt..... 1.25
Speed Toys for Boys, LaBerge..... 1.25
Puzzles in Wood, Wyatt..... .60
Coping Saw Work, Worst..... 2.40

Advanced

Simple Colonial Furniture, by Franklin H. Gottshall, Formerly Director of Industrial Arts, Mt. Berry College, Georgia.

A series of excellent projects, based on early American design, and worthy of a place in every American home. Thoroughly described and illustrated by many working drawings.

Cloth, 124 pages; 7¾ x 10¾". Price, $2.50.

Principles of Mill and Paint Shop Practice, by Ralph G. Waring, Instructor of Mill Room Practice, Cabinet Making and Paint Shop Practice, Delaware Prevocational Department, Syracuse, New York.

Contains a most comprehensive study of every phase of wood finishing. Begins with a study of woods and includes every practice employed in hand wood finishing. Profusely illustrated.

Leatherette, 388 pages; 6¾ x 9⅜". Price, $5.00.

Principles of Woodworking, by Herman Hjorth, Instructor Architecture Laboratory Work, Saunders Trade School, Yonkers, New York.

A thorough explanation of the most fundamental and commonly used tools and processes in woodworking. Much related material is included, and some excellent projects apply the information learned.

Cloth, 307 pages; 6 x 9". Price, $1.76.

Furniture Boys Like to Build, by Richard Shaver, Advanced Drafting and Woodwork Instructor, High School, Saranac Lake, New York.

Modern projects which apply a variety of processes in a manner best suited to the abilities and interests of the average boy. Carefully illustrated by half-tones and working drawings.

Cloth, 216 pages; 7⅝ x 10". Price, $3.00.

Instructional Units in Wood Finishing, McGee and Brown..$1.60
100 Problems in Woodwork, DeVette..... 2.00
Problems in Furniture Design and Construction, Madsen and Lukowitz..... 2.50
Furniture Inlaying, Frost and Fullerton..... 2.50
More Problems in Woodwork, Worst..... 3.00
Projects in Furniture Making, Adams..... 1.45
Reproduction of Antique Furniture, Hjorth..... 3.50
Measured Drawings of Early American Furniture, Osburn and Osburn..... 1.80
Fiber Furniture Weaving, Gandre..... 1.75
Furniture Weaving Projects, Hyatt..... 1.75
A Course in Wood Turning, Milton and Wohlers..... 1.50
Problems in Artistic Wood Turning, Ensinger..... 1.25
Wood Pattern Making, Hanley..... 1.35
Roof Framing, Rees and Nelson..... .64
Essentials of Upholstery, Bast..... 1.60
Practical Wood Carving, Elementary, Rowe..... 1.75
Practical Wood Carving, Advanced, Rowe..... 1.75
Industrial-Arts Tests, Test I, Woodwork, Nash and Van Duzee—
Individual Set, Scale A..... .25
Quantity Set 1.25
Individual Set, Scale B..... .65
Quantity Set 1.10

Farm Mechanics

The Farmer's Shop Book, Roehl..... 2.80
Fitting Farm Tools, Roehl..... 1.00

Automotive

Automotive Service, by Ray F. Kuns, Principal, Automotive Trades School, Cincinnati, Ohio.

An encyclopedic text covering every phase of the automotive trades and entirely up-to-date. Contains over 2,000 illustrations, 1,120 pages, and 803 actual service operations.

Fabrikoid, 1,120 pages; 6¼ x 9¼". Price, $6.50.

Automotive Essentials, by Ray F. Kuns.

A textbook for high-school student drivers, organized on a definite

The Bruce Publishing Company, 524–544 No. Milwaukee St., Milwaukee, Wis.

To be Reproduced for School Shop Use Only
Copyright, 1933, The Bruce Publishing Company

ELE. WOODWORK
CLIFFORD B. SMITH

STORY OF THE FILE

CLASS DEMONSTRATION SHEET — D-5

FILES ARE KNOWN BY THE;-

CUT OF THE TEETH,-

COARSENESS OF THE CUT,- ROUGH, MIDDLE, BASTARD, SECOND-CUT, SMOOTH AND DEAD SMOOTH.

SHAPE OF THE BLADE,-

THE FILE: A TOOL OF LAST RESORT

PURPOSE- To study the origin, development and use of the file. We will also consider the various shapes and styles common to a wood shop of to-day.

THE LESSON- ORIGIN- To shape, by means of rubbing an article, with a substance that is harder and more or less rough, was one of the most primitive of tool processes. It still remains, in wood work, a very unsatisfactory method to employ. The primitive savage rubbed by the hour and often for days, with a stone like this to form his bow and his arrows. Stones of different shapes and of varying degrees of hardness and roughness were used.

-A-

Whenever you take a file, when a cutting tool could better be used, you show the stage of your mental as well as physical retardation. Even the savage learned to prefer the cutting edge and his eager mind appreciated its superior qualities. Do you?

DEVELOPMENT- Stone did not allow much opportunity for improvement. Rasps very likely preceded files due to the greater ease in making. Copper in a flat sheet, with holes punched at intervals, formed a tool that scraped much faster than the original stones. This Age of Copper and finally of Bronze came only a few centuries before historical times.

-B-
Holes punched in sheet copper

It was only a short step from a flat rasp to making it cylindrical in shape. These tools were of too soft a material to withstand hard usage however.

-C-

The introduction of iron made possible the modern file and rasp. Their shape has been, from the beginning, about the same as the common forms of to-day. The teeth of course were very crudely formed and tore off particles by mere force.

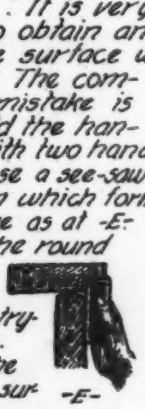
FORMS- The illustrations above include forms used in metal work as well as wood work. We will not consider here the important place the file occupies in the metal trades. In woodwork the file is a second class tool. The chief advantage that a file can claim is its ability to reach out-of-the-way places.

Files for woodwork have a wider space from one cutting edge to the next, than those used in metal work. This enables the tool to keep clean better and the file card can remove the soft particles more readily. Hard substances form smaller filings.

Double cut files cut faster than the single cut, while the latter cut smoother.

For woodwork the flat and half-round, double and also the rasp cuts, are the ones generally used.

USE- . It is very difficult to obtain an accurate surface with a file. The common mistake is to hold the handle with two hands and use a see-saw motion which forms an edge as at -E-. Note the round edge shown by the try-square. Note the rough surface.


-E-

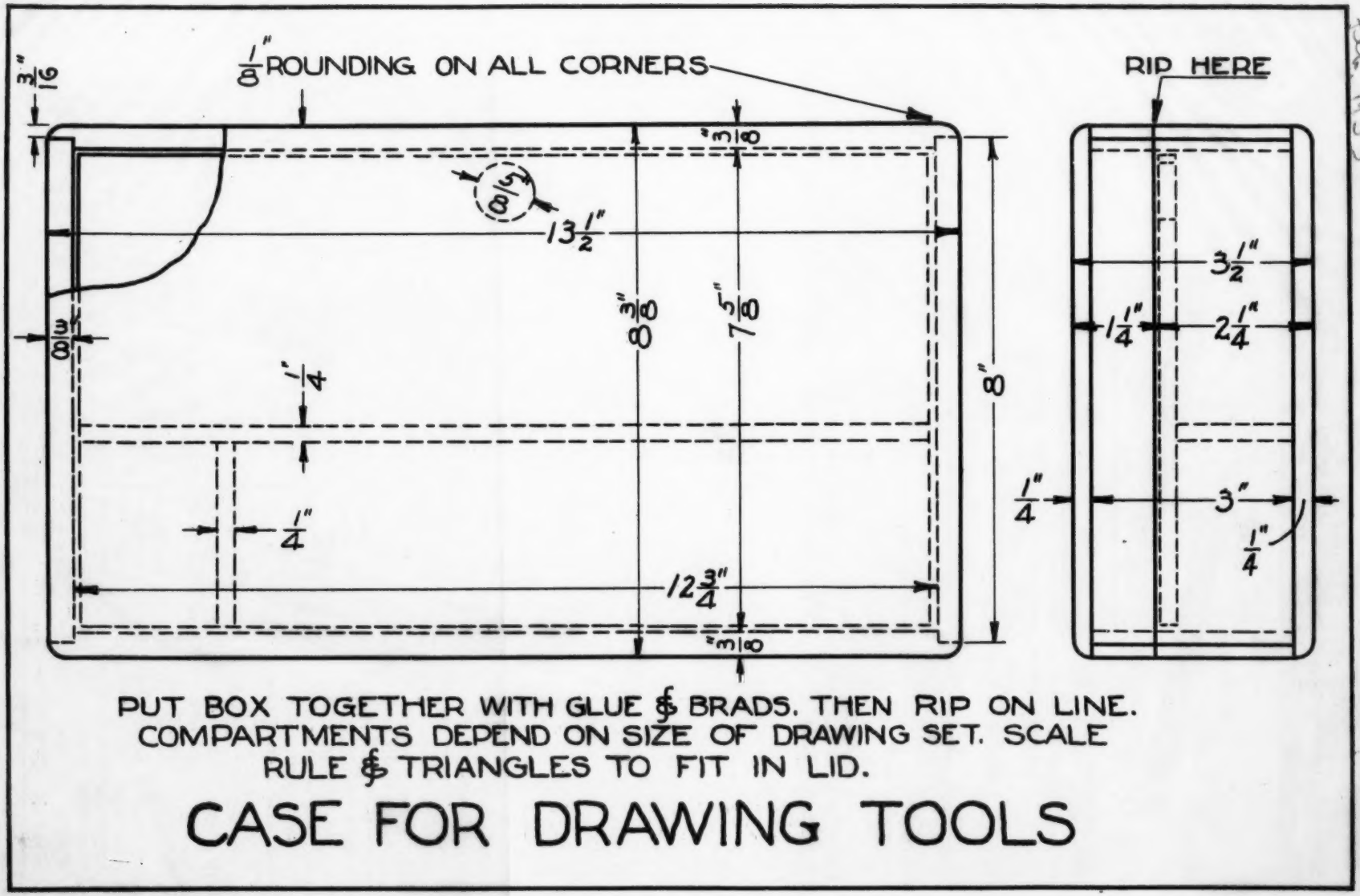
-D-

Allow the file to pivot between the thumb and first finger of the left hand, while the right imparts a side swing on the forward stroke. Pick up the file at end of the stroke. File teeth only cut on the out stroke. This method makes possible a squarer cut.

QUESTIONS- Does a file cut as rapidly as a chisel or plane? Does it produce as accurate work? Does it leave as fine a surface? If not, why do you use it? It is the tool of the slovenly workman, the one too lazy to acquire the necessary skill to use a cutting tool. A person who prefers a file belongs to ox-cart days, slow and inefficient!

Designed by Clifford B. Smith, Buffalo, N. Y.

To be Reproduced for School Shop Use Only
Copyright, 1933, The Bruce Publishing Company



PUT BOX TOGETHER WITH GLUE & BRADS. THEN RIP ON LINE. COMPARTMENTS DEPEND ON SIZE OF DRAWING SET. SCALE RULE & TRIANGLES TO FIT IN LID.

CASE FOR DRAWING TOOLS

Designed by Glenn H. Osborne, Ottumwa, Iowa.

Described Elsewhere in This Issue